

BOOKS AND PUBLICATIONS

APPLIED BIOCHEMISTRY, by Withrow Morse; 1925, illustrated in black and colors; size $6\frac{1}{4} \times 9\frac{1}{2}$, cloth, 958 pages, 257 figures, appendix (pages 863-920); index (pages 921-958), \$7.00. W. B. Saunders Company, Philadelphia. *From the Preface:* The following pages have been written with a view to weaving the woof of biochemistry into the warp of medicine. The student of general chemical physiology already has at his command excellent treatises. There remains the task of providing medical students with the biochemical facts and principles which bear more or less directly upon his science and art. Each of the sciences contributory to medicine tends to grow. It is essential, therefore, if the curriculum is to remain well balanced, that each department present only such material as is definitely related to medicine as a whole. This book aims to present biochemistry.

APPLIED BIOCHEMISTRY, by Withrow Morse, Professor of Physiological Chemistry and Toxicology, Jefferson Medical College, Philadelphia. 958 pages and many illustrations. W. B. Saunders Company, Philadelphia. This book aims to provide "the medical student with the biochemical facts and principles which bear more or less directly upon his science and art." That it does so and does so admirably speaks well for the acquaintance of the author with the needs of the medical initiate. A novel feature of the presentation, and one which is the chief contribution to practicality, is the interspersing in the text of laboratory exercises pertinent to the subject under discussion. An objection that might be raised on the part of the medical student is the prolixity of the structural formulas which are sprinkled with lavish hand. These will, however, undoubtedly assist in constructive visualization, if they do not at first stun by their strangeness. It is a question as to whether or not the instillation of such matter is of any practical use to the student save to enable him to parade as a practitioner the information before gaping patients. The presentation of photographic reproductions of contemporary biochemists is of course pleasing to the sitters and may act as a stimulus to the beginner. By and large, the book is very well done. The typographical errors are few and the type is pleasantly readable. Perhaps the use of a lighter paper in the second edition would make the volume easier to handle.

F. S. HAMMETT.

DISEASE IN CAPTIVE WILD MAMMALS AND BIRDS, Incidence, Description, Comparison, by Herbert Fox; 1923, illustrated; size 7×10 , cloth, 666 pages, 87 figures, index pages 661-665. J. B. Lippincott Company, Philadelphia. *From the Foreword:* The work on which this book is based was begun in November, 1901. From that date systematic autopsies were made on animals dying in the Philadelphia Zoölogical Garden. Previously autopsies had been made very rarely and only on animals of especial importance and interest.

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Pathological conditions were occasionally noted on animals subjected to anatomical study. Dr. Henry C. Chapman, a former director, whose interest was in physiology and comparative anatomy, made nearly all the autopsies before the beginning of the present work. In the annual reports from the foundation of the Garden in 1872, very few such examinations are recorded. This state of things was not peculiar to the Philadelphia Garden. It existed in every zoological garden in the world. This book gives results of the study of animals that have been subjected to experimental procedures and conditions, and though their mode of life has not been that strictly natural to them, yet they have not been influenced by any of the artificial procedures of the laboratory which are usually followed in investigations on animals. Though the object of the work was the pursuit of knowledge for its own sake, yet results of practical value have followed: hygiene has been improved; disinfection has been made scientific; epidemics have been arrested; some diseases, notably tuberculosis in monkeys, and spiropteriasis in parrots, have been practically eliminated.

THE SCIENCE OF BIOLOGY, An Introductory Study, by George G. Scott; 1925, 617 pages, including a 27-page index. Size $5\frac{1}{4} \times 8\frac{1}{2}$, cloth, \$3.50. Thomas Y. Crowell Company, New York. The book is divided into four parts. Part I is introductory and contains an account of the various biological sciences, also a general study of protoplasm and the cell. Part II considers the biology of plants, and Part III that of animals. Part IV deals with general topics, such as comparative anatomy, histology, embryology, heredity, and evolution.

THE ANATOMY OF THE ROOT-CANALS OF THE TEETH OF THE PERMANENT DENTITION, by Walter Hess, and *The Anatomy of the Root-Canals of the Teeth of the Deciduous Dentition, and of the First Permanent Molars* by Ernst Zürcher; 1925, illustrated; size $6\frac{1}{4} \times 9$, cloth, 20 pages, 63 plates (1380 illustrations), \$5.50. William Wood & Co., New York.

THE ROCKEFELLER FOUNDATION, A Review for 1924, by George E. Vincent, President of the Foundation; 1925, 48 pages, illustrated. Size $6 \times 9\frac{1}{4}$, paper cover. The contents include principles and policies, progress of research, medical education, training for health workers, public health, fellowships, consultation and field services, agencies, finances, organization.

METHODS AND PROBLEMS OF MEDICAL EDUCATION. First Series, 1924. Papers by C. R. Bardeen, G. Elliott Smith, Davidson Black, A. Brachet, H. Braus, E. Ludwig, H. B. Ferris, and others. Size 8×11 , paper cover, 152 pages, very fully illustrated and indexed. Third Series, 1925, contains 19 papers, 242 pages, illustrated. Division of Medical Education, The Rockefeller Foundation, 61 Broadway, New York, N. Y.

DIRECTIONS FOR THE DISSECTION OF THE CAT, by Robert Payne Bigelow; 1925, size $5 \times 7\frac{1}{4}$, cloth, 48 pages. The Macmillan Company, New York. "The aim is to guide the student so that he may obtain by direct observation a clear vision of the organism as a whole, not as a series of isolated systems of organs. For this reason the program of dissection is arranged so that it may be carried out on a single specimen. Success in observation will depend in large measure on care in following exactly the directions for procedure, which form the important part of the book.

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FORTY-SECOND ANNUAL SESSION

Yale University, New Haven, Connecticut

April 1 to 3, 1926

ABSTRACTS

PAPERS TO BE PRESENTED

1. *The relative weights of three parts of the hypophysis of the 200-gram albino rat in the two sexes.* WILLIAM H. F. ADDISON and MARY ADAMS, University of Pennsylvania.

That the hypophysis of the normal female albino rat is heavier than that of the male having a like body weight was shown by Hatai ('13). In his study, the three closely associated parts of the hypophysis—pars anterior propria (distal glandular), pars intermedia, and pars nervosa—were weighed together. According to his figures, in 200-gram animals the hypophysis in the female is 83 per cent heavier than in the male. The question has arisen as to which part or parts may be responsible for this great difference. The volumetric method of Hammar, based on weighing-paper, has been used in the hypophyseal studies of Jackson ('17) and Rasmussen and Herrick ('22), and has been followed here. Serial sections of fourteen hypophyses, half from males and half from females, were used. Ten had been fixed in Bouin's fluid and four in Helly's (formol-Zenker). All results are based on comparisons made between figures evaluated for 200-gram animals.

The average weight of the seven female hypophyses was found to be nearly twice the average weight of the seven male hypophyses. This agrees with the observations of Hatai. Of the total excess weight of the female over the male hypophysis, 95 per cent is contributed by the pars anterior propria. The remainder is contributed jointly by the pars intermedia and the pars nervosa. Individual variations occur.

2. *The interpretation of the labial villi—a study in comparative vertebrate anatomy.* BARRY J. ANSON, Harvard Medical School.

In a further search for homologies, in lower vertebrates, of the labial areas of man and of the cat, the first question is where to look for lips. According to Kopsch, "In der Tierreihe kommen Lippen nur den Säugetieren zu, doch fehlen sie den Monotremen und Walen. Auch bei dem Menschen kommen hie und da keine Lippen zur Entwicklung."

Among the many amphibian and reptilian embryos in the Harvard Collection there are no structures which can be regarded as homologous to the lips of mammals, and apparently nothing to compare with labial villi.

In elasmobranchs, and in *Squalus* better than in *Raia* or *Torpedo*, a prominent fold occurs in the upper jaw of 50-mm. embryos, involving both epithelium and underlying connective tissue. This becomes in adults a well-known and striking feature. A detailed comparison will be made between this lip-like structure and the human lip, which, superficially at least, have much in common. A lower 'lip' in *Squalus* is well-marked only toward the corners of the mouth.

In large specimens of *Squalus*, denticles extend anteriorly from the dentigerous area, and appear in such position in relation to the teeth and 'lips' as to suggest the mammalian villi; yet in earlier stages of development, differences rather than resemblances are in evidence.

3. *The prechordal plate in a human embryo with small neuropore.* WAYNE J. ATWELL, Department of Anatomy, University of Buffalo.

The embryo (no. 52, U.B.E.C., no. 5072, Carnegie Collection) was obtained at an operation for tubal pregnancy. Thirteen pairs of somites are distinctly separated and four more pairs are indicated by slight constrictions. In many respects the embryo is intermediate between no. 470 of the Carnegie Collection and no. 2053, described by Davis. The neuropore is present, but very small. The pharyngeal membrane is not perforated, although changes in the epithelium indicate places at which perforation is to occur. Communication of the yolk sac with the gut is wider than the Davis embryo; more so even than in no. 470. The dorsal flexure is well marked, but the curves are gentle and do not necessitate considering the bending as due to artifact. The atrial portion of the heart has not risen up dorsal to the bulbar portion. The first pair of aortic arches is complete, while the second pair is in an early stage of formation.

At the cephalic end of the notochord is a structure which is probably to be interpreted as a rudimentary prechordal plate. The lateral extensions are not so extensive as in the embryo with seven pairs of somites described by Payne. The structure bends around the cephalic end of the foregut and for a large part of its length is free of attachment to either ectoderm or entoderm.

4. *Certain histological changes which occur in the guinea-pig testis as a result of experimental tuberculosis.* (Work done under grant from the National Tuberculosis Association.) GEORGE A. BAITSELL, KARL E. MASON, and MARION B. SHEERWOOD, Osborn Zoölogical Laboratory, Yale University.

In connection with work which we are doing on the development of the tubercle, particularly with reference to the formation of fibrous tissue, several series of experiments have been carried out on the guinea-pig testis, the preliminary histological studies of which are proving to be of considerable interest.

Following testicular inoculation with virulent strains of tubercle bacilli, there is a rapid degeneration and elimination of the germ cells, associated with abundant formation of multinucleate giant cells through fusion of these degenerating germ cells and followed by a rapidly increasing intertubular infiltration of epitheleoid cells. This process begins earlier and, in general, is more severe in the testes of reinfected animals than in those of animals infected for the first time, as has been shown by Long and Miller. Later, multinucleate giant cells arise in the areas of infiltration. Whether or not these also arise by fusion is not settled.

Another prominent histological feature is the development of considerable areas of fibrosis, especially in the fatty tissue adjacent to the testis and epididymis. The evidence appears clear that this fibrous tissue arises by direct transformation of an intercellular exudate, as has been shown in several instances to be the case in normal development in the embryo and in wound healing.

5. *The development of synovial sheaths.* O. V. BATSON, Department of Anatomy, University of Cincinnati.

Analysis of the mechanical factors active at the time of the development of synovial sheaths seems to indicate that they differentiate in response to function. Certain mechanical relations between the annular ligament, the tendon, and the synovial sheath have not been previously considered. Further, although the idea may be said to date back to His, clear-cut evidence in its support has been lacking. Specimens are presented in which the limitation of mechanical factors has been accompanied by failure of development of synovial sheaths. This paper is correlated with others previously presented, in an effort to give a connected history of the functional development of the accessory structures of muscles.

6. *Coordinate and incoordinate evolution in man.* R. BENNETT BEAN, School of Anatomy, University of Virginia.

Incoordinate evolution is represented by the incidence of certain characters in the three great races of man. Thus the nose is broad and flattened in the black, narrow and high in the white, and intermediate in the yellow-brown. The woolly hair of the black and the straight hair of the yellow-brown are extremes, neither of which has been reached in the white. The dark skin of the black and the light skin of the white are more extreme than the intermediate coloring of the yellow-brown. The glabrous yellow-brown and the hirsute white are more extreme than the intermediate hairiness of the black. The ear type of the white is between that of the black and the yellow-brown. The large brain of the white and the small brain of the black are more extreme than the brain of the yellow-brown. The legs of the blacks are relatively to the sitting height the longest, those of the

yellow-brown the shortest, and the white in between. The hands of the yellow-brown are relatively the longest, those of the whites the shortest, and the blacks in between. Many other characters like these represent variables of oscillation in evolution.

On the other hand, coordinate evolution is represented by certain characters in the three fundamental types. The hypomorph is short and broad, the hypermorph is long and narrow, and the mesomorph is in between in stature, cranium, face, ear, nose, teeth, tongue, palate, shoulders, hips, thorax, abdomen, stomach, liver, arms, legs, hands, feet, fingers, and toes. A great many other characters are associated with these that represent coordinate evolution within the race.

7. *Observations on the physiology of the gall bladder.* EDWARD A. BOYDEN, Harvard Medical School.

Following the demonstration that the gall bladder could be emptied by the ingestion of appropriate food, a careful study of its behavior during contraction was undertaken. Volunteer patients prepared for cholecystography (by Whitaker's modification of Graham's method) were x-rayed at fifteen-minute intervals. In four out of five cases the gall bladder collapsed approximately two and one-half hours after yolk and cream were eaten, the fifth requiring four hours. The contraction curves obtained by plotting planimeter readings of successive gall-bladder shadows reveal a rhythmic behavior of that organ, three to five successive impulses of contraction being required to empty the vesicle. Meat, in four out of five cases, produced only partial emptying, thereby permitting a study of the process of filling. Of special interest were the few cases recording the effect of both diets on the same individual. These showed that a given gall bladder always takes the same time to reach a lowest point in its curve, but that the character of the curve varies with the diet.

Using a special method devised by Doctor Whitaker, we have been able to show that gall-bladder bile may reach the intestine within five minutes after ingestion of yolk, that the bile is expelled by the intrinsic musculature of the gall bladder, and that transfusion of blood from a donor cat fed with yolk causes contraction of the gall bladder of a fasting animal.

8. *The comparative embryology of the mammalian vena cava posterior.* ELMER G. BUTLER, Princeton University.

On the basis of a detailed knowledge of the formation of the posterior vena cava in the cat (Huntington and McClure, '20) and in man (McClure and Butler, '25), embryos of various other mammals have been examined with the purpose of gaining a more accurate understanding of the method of development of this vein in mammals in general. Embryos utilized have been those of the pig, sheep, bat, rabbit, and rat, which serve as a representative group of mammalian embryos so far as the requirements of the present study are concerned.

Results indicate that the establishment of the adult venous system is always in accordance with a common embryonic plan which is applicable to all mammals. Constant and typical variations observed both in the method of development and in the adults among different species of mammals become intelligible through a knowledge of the relative functional rôle which the embryonic veins (posterior cardinal, subcardinal, and supracardinal) may play during the course of ontogeny

in the formation of the posterior vena cava. Likewise, atypical conditions frequently discovered in adults of any particular species of mammal may be interpreted on the same basis.

9. *The pallial commissures in *Sphenodon punctatum**. JOHN CAIRNEY (introduced by C. Judson Herrick), Department of Anatomy, University of Chicago.

In *Sphenodon*, as also in the *Lacertilia*, the commissural fibers of the hippocampus are divided into two groups, the commissura pallii anterior and the commissura pallii posterior (commissura fornicis of Dendy, commissura aberrans of Elliot Smith). Both are formed by fibers from the alveus. The anterior is unmyelinated and crosses in the lamina terminalis (lamina supraneuroporica of Johnston's interpretation). The posterior is myelinated and crosses above and behind the interventricular foramen—in the embryo in the velum transversum (Elliot Smith, Dendy). These fibers are certainly related with hippocampal cortex. Whether they extend into other cortical fields also is uncertain.

The commissura pallii anterior consists of fibers from probably rather less than the rostral half of the hippocampus. These fibers form a well-defined bundle running caudally and somewhat ventrally in the substance of the septum.

The commissura pallii posterior contains fibers from probably more than the caudal half of the hippocampus; those which come from in front of the level of crossing form a bundle running caudally at the ventral border of the column of hippocampal cells. The nucleus commissurae pallii posterioris is intimately related both with the commissure and with the stria medullaris.

The question arises whether, in addition to the differences in myelination and in topographical relation, there is also a functional difference between the two commissures.

10. *Studies on living wandering cells*. ELIOT R. CLARK and ELEANOR LINTON CLARK, Anatomical Laboratory, Medical Department, University of Georgia.

The purpose of this study was to secure data regarding the free wandering cells of the tissue spaces. Amphibian larvae were removed from the jelly and studies made of the wandering cells in the fin from the time they first became visible.

Before blood and lymphatic vessels invade the fin there are present, beneath the epidermis, only stellate connective-tissue cells. Between them wandering cells migrate from the axis of the tail. At first they resemble one another closely, but soon differentiate into three types: 1) subcutaneous canalicular cells which become stationary; 2) one type relatively fixed chromatophores, and, 3) large mononuclear wandering cells which continue indefinitely as amoeboid cells.

The last named, at first clear, soon develop pigment granules. They move continuously through the tissue spaces, sometimes flattening out on capillaries and occasionally entering the lumen of blood or lymph capillaries. They enter the intercellular spaces of epidermal cells and move about there. In this ceaseless movement they phagocytize extravasated erythrocytes, dead cells, and injected foreign substances, evidently without limit. They are very resistant and persist throughout the life of the tail. They are identical with the large mononuclear cells variously termed histiocytes, clasmatoocytes, macrophages, etc. They do not arise from mesenchyme cells or endothelium in the region observed.

The behavior of polymorphs and of small mononuclear cells resembling lymphocytes was also studied.

11. *Nissl granules of primary afferent neurones.* SAM L. CLARK (introduced by S. W. Ranson), Washington University Medical School.

A study was made of the Nissl granule arrangement of the primary afferent neurones of the dog and other vertebrates. It was found that several cell types could be identified, some of which correspond with earlier classifications of spinal ganglion cells, but that additional groups were necessary for some cranial nerve ganglia. The percentages of various cell types in cranial nerve ganglia could be correlated for the most part with known functional components of the nerves. Correlation of cell type with function could thus be made in some cases, though a hard-and-fast line could not always be drawn. The cells of origin of proprioceptive fibers from muscle spindles, including those of the mesencephalic nucleus of the trigeminal nerve, are of the large, finely granular clear-cell type; though not all such cells are proprioceptive. Visceral afferent fibers of the cranial nerves show a definite cell type which occurs in the majority in the nodose ganglion of the vagus and in other ganglia. Strangely, the cells of the vestibular and cochlear ganglia are of types resembling certain efferent neurones. Analysis of examples of Froriep's ganglion show it to be probably an aberrant spinal ganglion.

12. *The capacity of function and of growth of the motor neurones of Amblystoma.* G. E. COGHILL, The Wistar Institute of Anatomy and Biology,

The writer has observed many instances of innervation of contractile myotomes of *Amblystoma* by a single ventral root fiber. Such myotomes are functional in the locomotor trunk flexures. In one embryo that could swim as many as fourteen successive myotomes were innervated by a single motor fiber to each of the several pairs of muscles. Simultaneously, the neurones from which the root fibers arise participate in the integration of the trunk as a whole by longitudinal conduction in the spinal cord. In addition, the fibers of the brachial nerves, while innervating functional muscles of the trunk, are growing into the primordium of limb musculature. The root fibers of the hypoglossal nerve, also fulfill all these same conditions.

The function of motor neurones is, therefore, extended greatly after they have assumed an active rôle in reflex circuits. Moreover, such growth of functional neurones effects the development of the behavior pattern of *Amblystoma* up to and including locomotion, and insures the total integration of the organism, while effectors or effector systems acquire various degrees of individuation within it.

The *Amblystoma* embryo offers opportunity for physiological studies upon a single nerve fiber in the innervation of muscle. If such studies could be made quantitatively, they might have important bearing upon the problem of nerve conduction.

13. *The vascularity of vagus nuclei and of parts of the reticular formation in the albino rat.* E. HORNE CRAIGIE, Department of Biology, University of Toronto.

The total length of the capillaries in a unit volume of tissue has been measured in the dorsal motor vagus nucleus, the nucleus of the solitary fasciculus, and two areas of the reticular formation about the region where the respiratory nucleus is supposed to be situated.

In adult rats, the dorsal motor vagus nucleus is the most poorly supplied with capillaries of all the gray centers studied except the substance of Rolando. The nucleus fasciculi solitarii is the poorest sensory center except the substance of Rolando, three motor nuclei being more vascular than it is.

The two areas of reticular formation are about the level in vascularity of the richer motor nuclei, the 'nucleus respiratorius' of Bechterew being the better supplied of the two. Since these regions contain large numbers of white fibers, the gray matter in them must be plentifully vascularized, ranking with the richer centers.

At birth these four regions correspond in capillary richness with other parts, the characteristic differences not yet being established. The postnatal changes resemble those previously recorded for the rest of the brain stem.

14. *Comparative studies of palmar and plantar epidermal configurations: racial distinctions in Jews.* HAROLD CUMMINS and CHARLES MIDLO, Department of Anatomy, School of Medicine, Tulane University.

The present study is based upon Jews resident in New Orleans, 100 males and 100 females. Ascertainable racial admixtures, as well as family relationships, have been avoided in the collection. The material embraces palmar main lines and patterns, apical finger patterns, and (for males only) patterns of the sole. Following, there are shown several findings which are outstanding in comparison with representative collections of European-Americans.

As in European-Americans, the distinctive palmar main line formula is the 11.9.7.5 type, preponderating in right hands.

Jews display a marked preponderance in left hands of the second most common formula, the 9.7.5.5 type. There is a significantly increased representation of patterns on the thenar eminence and in the third palmar interdigital area. Apical finger patterns are noteworthy for the high incidence of whorls. The hallal pattern is more frequently of the W type than the A, reversing the condition obtaining in European-Americans. Both the first and second plantar interdigital areas show reduction of the O type, with corresponding increase in the incidence of true patterns.

15. *Estimation of fetal values by extrapolation of autocatalytic formulae based on postnatal brain data.* HALBERT L. DUNN, School of Hygiene, Department of Biometry and Vital Statistics, Johns Hopkins University, and R. E. SCAMMON, Department of Anatomy, University of Minnesota.

The skew autocatalytic equation,

$$\text{Brain part weight} = \frac{K}{1 + e^{a+ax+cx^2+dx^3}}$$

in which x is the body length and K , a , b , c , and d are constants determined by the method of least squares, has been fitted to the observed encephalon, cerebrum, cerebellum, pons-medulla-midbrain weights in postnatal life.

The symmetrical autocatalytic equation,

$$\text{Brain part weight} = \frac{K}{1 + e^{a+bx}}$$

in which x is the body length and K , a , and b are constants obtained in a similar manner has been applied to corresponding observed prenatal brain weights.

Fetal values can be estimated by extrapolation of formulae based on the postnatal material. No significant difference exists between these extrapolated values and the observed fetal material.

16. *The initial infertility of early copulations in the normal male rat.* HERBERT M. EVANS, University of California.

Studies of the possible effect of dietary regimes on fertility must take account of a transitory period of infertility in normal young male rats. As Stone has shown, the production of spermatozoa precedes the awakening of copulatory power in this animal. Yet the first and in some instances the first few copulations (which occur about the sixty-fifth day) are sterile. The first 'plugs' are devoid of spermatozoa or possess immotile spermatozoa; rarely they possess motile spermatozoa. When, a few days later, motile spermatozoa are abundant, these may still be incapable of fertilizing ova in mature females of proved fertility.

17. *Effects of anterior hypophyseal extracts on the male.* HERBERT M. EVANS and MIRIAM E. SIMPSON, University of California.

The experimental production of gigantism and the striking inhibition of ovulation caused by treating female rats with anterior hypophyseal hormone led to study the effect of the treatment on males. Ten males were injected daily intraperitoneally with the whole, neutralized, alkaline extract of bovine anterior hypophysis beginning on the twenty-first day of life. Beginning with the sixtieth day of life, they were bred weekly with vigorous females of proved fertility in active oestrus. Five litter-mate brother untreated controls were studied. The male rat shows the same gigantism demonstrated in females. With a single exception, the treated animals were from 100 to 250 grams heavier than their normal controls at eight months of age. One individual weighed 680 grams, its control 450 grams. In seven cases by the end of the fifth month there was demonstrable a clear diminution in sex response as determined by refusal of the male to copulate with different females in active oestrus, renewed daily from two to ten days consecutively. With one exception, however, copulation was always eventually accomplished and the production of healthy litters has demonstrated the persistence of fertility in the giants. Autopsy of two cases with their controls showed great relative and considerable absolute diminution of testis weights with smaller tubules, but with no evidence of degenerative changes—facts in agreement with the persistence of normal morphology and motility of spermatozoa in the fresh ejaculate.

18. *Abnormal development in amphibian embryos.* CAROL FISHER (introduced by ROSS G. HARRISON), Yale University.

In a bunch of about one hundred albino eggs of *Amblystoma punctatum*, thirty-six interesting monstrosities were found ranging in form from complete double monsters united by their yolk to double embryos of unequal size, and to very abnormal single individuals. Since the occurrence of amphibian monsters in nature is rare, an attempt was made to produce them experimentally, using depressants—magnesium chloride, magnesium sulphate, ether, chloroform, alcohol,

low temperature. The eggs were found very resistant and not easily affected by these agents, except in intensities that caused their death. Depriving the eggs of oxygen in early development proved more effective in producing abnormalities, such as the well-known spina bifida, anophthalmia, and one case of actual twinning.

Carbon monoxide, 80 or 90 per cent, mixed with oxygen, had no effect on early development of *Amblystoma* embryos, even after hemoglobin was formed. The normal formation of erythrocytes was not inhibited by the gas. Development proceeds normally, showing that the embryo is not entirely dependent on hemoglobin as a carrier of oxygen. However, prolonged exposure to carbon monoxide showed an effect on the nervous system, evidenced in the living embryo by lack of response to stimuli, and in some cases by marked degeneration. Later stages of embryos are more susceptible to carbon monoxide; adult frogs succumb after twelve hours.

19 a. Transformation of the simple-squamous peritoneal epithelium to a ciliated, columnar epithelium during the spawning season in the brook and in the lake lamprey. Comparison with Amphibia. SIMON H. GAGE, Cornell University.

Since 1913 there has been repeatedly demonstrated active ciliary movement on the peritoneal surfaces in both male and female brook and lake lampreys during their breeding season. In scrapings from the peritoneal surfaces the individual cells with their ciliary movement have been studied with high powers. In microscopic sections of the entire body the characteristic, columnar ciliated cells are shown on all peritoneal surfaces except parts of the dorsal surface where the simple, squamous form may persist. Unlike the Amphibia, in which the ciliary current is definitely toward the mouths of the oviducts, the ciliary movement in lampreys is irregular. Apparently some of the patches of ciliated cells cause a current in one direction and some in another without any definite goal.

19 b. Similarity of the changes in the alimentary canal during transformation from the larval to the adult stage in the parasitic lake lamprey and the non-parasitic brook lamprey. SIMON H. GAGE, Cornell University.

In all forms of lampreys so far investigated the changes in the alimentary canal in the transformation from the ammocoete or larval to the adult form consist of the following: 1) From a horse-shoe-shaped mouth there is formed a sucking disc bordered with soft papillae and armed within by horny teeth. 2) In the pharynx there appears a piston-like, rasping tongue bearing recurved, horny teeth. 3) In place of the common branchial and alimentary passage of the larva, there are developed two independent tubes: a) The branchial canal with lateral openings for the seven branchial pouches; b) an oesophagus leading from the pharynx to the intestine.

In the development of the oesophagus there is first a solid, epithelial cord. Later a cavity appears in this solid cord, both at the intestinal and the pharyngeal end, and the lumen gradually approaches from both directions until, with the lake lamprey, the oesophagus becomes tubular its entire extent before the animal leaves the mud and gravel (January-February) to live a parasitic life in the open water.

With the brook lamprey, on the other hand, which now has no parasitic life, there remains a short segment of the solid epithelial cord occluding the oesophagus in many if not in all specimens.

20. Dimensions of the basilar membrane in guinea-pigs. STACY R. GUILD,
Department of Anatomy, University of Michigan.

Midmodiolar orientation, serial sections, and good histologic preparations are essential for reliable data. In contrast to the usual descriptions of the basilar membrane, measurements of thirty-five thus qualified and similarly prepared guinea-pig cochleae show the greatest width to be about one full turn below the apical end, which is sometimes as much as nineteen per cent narrower than this widest part. Furthermore, the width at the third half-turn and at the fifth half-turn is frequently less than or only equal to that of the half-turn below; in many, although not in all, of the other individuals the rate of change in width in these two regions is much less than in other parts. There is much greater individual variation in the absolute width of corresponding regions of the basilar membrane than is recorded for other forms, so far as I am aware; possibly the larger number measured accounts for this. The thickness of corresponding parts also varies greatly; this has not been correlated with the width variations as yet. Such data have a fundamental bearing upon all theories of hearing in which the basilar membrane is regarded as a moving part, especially if other forms are found in which the basilar membrane differs as much from the usual conception as it does in the guinea-pig.

21. The hypothalamus in the rat. ELISHA S. GURDJIAN (introduced by G. Carl Huber), University of Michigan.

The hypothalamus in the rat has at least twelve nuclei. It is imperceptibly continuous with the preoptic area in front and the subthalamus dorsally. The medial forebrain bundle relates it to the olfactory centers anteriorly. Cortico-hypothalamic and striohypothalamic tracts are present. Ascending fibers from the region of the median fillet reach it through the mammillary peduncle. It is intimately connected with the mammillary bodies. The periventricular system of fibers connect the hypothalamus with lower centers and possibly also with the tectum. There are three distinct paths connecting the amygdaloid complex and the hypothalamus.

The mammillary bodies in the rat are highly differentiated, having a nuclear pattern which has distinct relations to the origin of the combined mammillothalamic and the mammillotegmental tracts. We were able to divide the latter into its component portions on the basis of their origin from the different parts of the medial group of nuclei. The mammillotegmental tract arises from the more anterior portions of the mammillary complex. It is in part at least a bifurcation product of fibers, the cell bodies of which are located in the medial group of mammillary nuclei. The other product of bifurcation forms the mammillothalamic tract. The mammillary peduncle in the rat consists of both ascending and descending fibers; by far the majority, however, are ascending in nature.

22. *The blood supply of the kidney, suprarenal, and testicle, with special reference to the persistence of the postcardinal and subcardinal venous system in man.* H. A. HARRIS, University College, London, and Washington University, St. Louis.

Special attention is drawn to the persistence of the postcardinal and subcardinal veins in man, and their anastomoses as figured by Eustachius (1564) and Verheyen (1710). Both veins are seen in marsupials, and man illustrates the persistence of the primitive venous pattern, thus affording a marked example of 'foetalization' (Bolk).

The blood supply of the kidney is analyzed, and Langley's views of the insignificance of the capsular system of arteries and veins is disputed both from the point of view of injected preparations, pathological conditions of the kidney, and such operations as Edebohl's 'decapsulation.'

Various injection methods and the results of experimental occlusion of the subcardinal sex vein are considered.

23. *Postpubertal oogenesis in the opossum.* CARL HARTMAN, Carnegie Laboratory of Embryology, Baltimore, Maryland, and University of Texas.

In the opossum ovary there is a periodic outburst of oogenetic activity, but never from the entire surface of the ovary. On each side of the hilus a circumscribed nest of embryonic epithelium remains, from which ova are periodically fed into the ovary. This ooblastic center may be unmarked exteriorly, or may occupy a more or less prominent eminence. The ova are not produced singly, as in the mouse, but in strands, true 'Pflüger's tubes,' as in the embryo. In the dioestrus liaison is maintained (as nowhere else in the ovary) between the germinal epithelium and the parenchyma by means of strands of epithelial cells that pierce the albuginea. As an expression of this active proliferation, it is significant that the majority of aberrant structures, such as multiple and anovular follicles and polynuclear and moribund ova are located in the hilus region. The observation has a possible significance in relation to ovarian regeneration, continued menstruation after double ovariectomy in the human, and accessory ovaries.

The ovary is conceived to be an organ in ceaseless agitation, the growth of graafian follicles and their dehiscence or atresia and subsequent resorption resulting in kaleidoscopic changes during the reproductive period of the individual.

24. *The dorsal and anal glands of Callospermophilus.* ROBERT T. HATT (introduced by A. B. Dawson), New York University.

In the golden-mantled ground-squirrel, *Callospermophilus*, a diamond-shaped glandular area has been noted in the skin of the back. It has been found in the following species, *C. l. lateralis*, *C. l. arizonensis*, *C. l. carvi*, *C. l. saturatus*, *C. l. tescorum*, *C. c. chrysodeirus*, and *C. bernardinus*. Probably it is common to the genus.

The individual glands making up this area are modified and enlarged sudoriparous glands. They are divided into a tightly coiled and branched fundus, a large sinus, and a duct which passes caudad and outward to its exit at the surface.

The glands secrete a strongly smelling oil which is probably left on vegetation and other objects in the animal's environment and serves as a source of information to other members of the species. The glands are more active in spring and summer than in winter. They are stimulated by excitement. While present in both sexes, both adult and juvenile, they are best developed in adult males.

Callospermophilus has three anal glands. They have flat-topped straight-sided nipples which are protruded from the anus if the animal is frightened. They extrude a milky substance with a very weak odor.

25. *On the emptying of the gall bladder.* G. M. HIGGINS and F. C. MANN, Division of Experimental Surgery and Pathology, Mayo Foundation.

Following the method described by Boyden on the effect of natural foods on the distention of the gall bladder in the cat, studies have been made upon the emptying of this vesicle in several species of animals, especially the fish, the guinea-pig, and the dog. We have corroborated Boyden's findings as regards the use of egg yolk and cream in emptying the vesicle, and with this method at hand we have performed a large number of experiments on the mechanism involved in the process.

The results of these experiments suggest the following conclusions:

- a. The gall bladder empties through the cystic duct.
- b. The motor mechanism, residing in the wall of the gall bladder, is a primary factor in the process of its emptying.
- c. Changes of intra-abdominal pressure are probably not of great significance in emptying the gall bladder.
- d. Intrahepatic secretory pressure does not appear to be a factor in emptying the gall bladder.

26. *Studies in the innervation of certain muscles of the frog.* MARION HINES-LOEB, Department of Anatomy, Johns Hopkins University.

The sartorius, pectoralis abdominalis, coracoradialis, and the submaxillaris muscles were studied with the methylene-blue technique. Large and small muscles were noted in all but the submaxillaris. Often the same axis cylinder of a medullated nerve innervated the two, and in some instances a non-medullated nerve entered and joined the motor end plate. Besides these two sizes of muscles mentioned, there are fine slender fibers whose nuclei lie in the center of the cylinder. Their innervation resembles that found in mammalian spindles; that is, a medullated and a non-medullated fiber contribute to the ending. They are found singly or in groups of two or three and unencapsulated. Besides these there are epilemmal grape-like terminations often in contact with the small muscle, more numerous in the pectoralis abdominalis, and a medullated leaf-like ending which lies free among the fibers.

Because these muscles are thin, they could be studied as a whole, without teasing. Consequently, not only the ending could be seen, but the point at which its axis cylinder joined the trunk of distribution could be discovered.

27. *The rôle of the sympathetic nervous system in muscle tonus.* JOSEPH C. HINSEY and S. W. RANSON, Washington University Medical School.

The left lumbar sympathetic trunk was removed through a median abdominal incision in cats. Autopsy showed the left trunk had been completely removed from the second lumbar to below the brim of the pelvis and that the right trunk was intact. After postoperative periods varying from fifty to seventy-seven days, five of these cats were decerebrated by ligation of the basilar and both carotid arteries. No difference between the sound and the sympathectomized limb could be detected either as to posture or rigidity. Using a simple device, the pressure required to flex the limb was measured in ounces and the time required in minutes. The measurements were repeated several times on each cat, and such differences as exist between the two sides, sometimes in favor of the normal side, sometimes against it, disappear when averages of the whole series of measurements are considered.

Three other sympathectomized cats were given tetanus toxin, injecting equal quantities subcutaneously over the femoral trochanter in each hind leg. The degree of rigidity and the abnormal posture which developed in the two limbs were identical. These experiments show that the sympathetic nervous system is not responsible for exaggerated muscle tonus caused by decerebration or the action of tetanus toxin.

The nerve to the vastus intermus muscle is being studied to determine the effect of sympathectomy on its unmyelinated fiber content.

28. *Histological changes in the suprarenal cortex produced by various chemical substances and toxins.* NORMAND HOERER (introduced by B. C. H. Harvey), University of Chicago.

Demonstration of some changes in the cortex of the suprarenal gland of guinea-pigs and rabbits in conditions experimentally produced, after infections and after injections of chemical substances and toxins subcutaneously. Among the experimental conditions studied are occlusion of the ureters and subjection to a scorbutic diet. Among the chemical substances and toxins are dichlor-diethyl sulphide (mustard gas), cobra venom, diphtheria toxin. The infection studied is rabies.

The conditions following include hyperaemia (in all), hemorrhage (after diphtheria), reduction in lipid content (after dichlor-diethyl sulphide, cobra venom, scorbutic diet), vacuolization of cells (after cobra venom and scorbutic diet), and focal degeneration (after rabies, uraemia, cobra venom, scorbutic diet, and dichlor-diethyl sulphide).

29. *The effects of drying in various parts of the earthworm, Lumbricus terrestris.* C. M. JACKSON, Institute of Anatomy, University of Minnesota.

At room temperature of 18° to 19°C., the earthworms in December survived a loss of 43 per cent in body weight during five hours of desiccation, but did not survive longer periods with losses of 50 to 60 per cent. The curves of body weight during desiccation and recovery upon replacement in water are similar, but recovery is slower, requiring about twenty-four hours. The normal water content in six specimens averaged 88.065 per cent (range 87.33 to 88.79).

Measurements of cross-sectional areas in celloidin sections were made on four specimens, one normal and three after losses of 31 to 47 per cent in body weight. The results indicate that during desiccation in the earlier stages the epidermis, body muscles, celomic cavity, intestinal wall, and lumen lose roughly in proportion to their original volume. But in extreme desiccation a relatively larger proportion of water is lost from the celomic cavity and the intestinal lumen.

Within the various tissues the loss appears to be chiefly from the intercellular spaces. The cells show but slight changes in size and structure, excepting the epidermis, where some shrinkage is apparent. Further details will be published in the Proceedings of the Society for Experimental Biology and Medicine.

30 a. Studies on lymph nodes. II. Development in the fetus and infant.

THESLE T. JOB, Loyola University School of Medicine, Department of Anatomy.

A series of fourteen fetuses and infants, from three months prenatal to three months postnatal, was studied. Dissecting binoculars and colored injections were used.

Results: Lymphoid tissue superficial to vaginal fascia is extremely rare. Increased fat increases lymphoid tissue, which is more diffuse than in cases of total absence of fat where the amount of lymphoid tissue is increased but better organized. Lymphoid tissue is quite diffuse prior to fourth prenatal month, but well organized at term. Organization is more rapid cranially, except in deformities of the upper extremities. In specimens of the same age, lymphoid tissue is better organized in the visceral groups than in the peripheral, in the female than in the male, and in the negro than in the white. A comparison of the various groups of nodes indicates that the cervical group, with the exception of the terminal nodes, is less well organized at any given age than any other group, but there is actually more lymphoid tissue in this group than in any other peripheral group. The mesenteric and gastric nodes are larger and more numerous than any other group. The number and arrangement of the axillary and inguinal nodes are practically constant after fourth prenatal month, the inguinal group having a few small scattered nodules throughout the series. The younger the node, the more evident its nodular structure.

30 b The anatomy of the duodenal portion of the bile and pancreatic ducts.

THESLE T. JOB, Loyola University School of Medicine, Department of Anatomy.

A study has been made of the anatomy of the duodenal portion of the bile and pancreatic ducts of 151 cadavers. Besides a careful dissection, air pressure, bristles, and hand lens were used to determine the relation of these ducts in 116 specimens. Thirty-five specimens were dissected under a binocular dissecting microscope. Typical specimens were serially sectioned.

Results: Ampulla of Vater, with maximum length of 5 mm. present in eight cases, or 5.3 per cent. Typically the two ducts are separate to tip of the duodenal papilla. Frequently the pancreatic duct forms a sinus at the tip of the papilla which almost encloses the bile duct.

The musculature of the duodenal wall does not form an efficient sphincter of these ducts. Each duct has an individual circular and longitudinal smooth-

muscle layer and a common circular and longitudinal layer almost to the tip of the papilla. Just inside the gut wall the bile duct has a very definite sphincter, and from this point on the two layers of muscle decrease until the longitudinal layer disappears 1 or 2 mm. from the tip of the papilla, the circular layer persisting to the tip, though only a few cells. The common and individual muscle layers seem to intermingle at various points.

The mucosa in papilla is extremely redundant, being thrown into pointed processes directed toward the tip of the papilla.

31. *The transformation of lymphocytes into erythroblasts in a lymph node of a rabbit.* H. E. JORDAN, Laboratory of Histology and Embryology, Medical School, University of Virginia.

In a submaxillary lymph node of a rabbit the medullary cords and certain perivascular areas of the cortex consist predominantly of erythroblasts at various stages of differentiation. Many of the medullary cords contain a thin-walled axial blood vessel about which the differentiating lymphocytes, mostly at normoblast stages, form a sheath of variable thickness bounded peripherally by an endothelioid reticulum membrane. Some cords lack an axial blood vessel; a few are in transition stages showing obliteration of the vessel by disruption of endothelium and cellular invasion of lumen. Certain cells have the nuclear and cytoplasmic characteristics of genuine lymphocytes, a few contain hemoglobin sufficient to impose a sharply contrasting bright red color on the cytoplasm, a considerable number of the more peripheral cells may be in process of karyorrhexis, and some give distinct evidence of nuclear resorption. Granulocytes are absent. There is no indication of mitotic proliferation; the binucleated condition of a number of cells suggests slight amitotic activity. This material gives unequivocal evidence of an erythrocytogenic capacity of lymphocytes under certain conditions, and suggests the method by which extravascularly differentiating erythrocytes in bone marrow may secondarily enter the medullary terminals of the vascular system. The specific stimulus underlying lymphocyte differentiation into erythrocytes in this node is presumably the condition of relatively high concentration of carbon dioxide consequent to stagnation in the blood stream.

32. *The Golgi apparatus in Anisolabis.* S. I. KORNHAUSER, University of Louisville.

Ovarioles of *Anisolabis* have peculiar amoebocytes located in the haemolymph between the egg strings and their tracheomuscular sheaths. These amoebocytes are abundant about young oocytes which show the first appearance of yolk granules. Haemolymph was studied with vital stains, neutral red proving most valuable. Amoebocytes with long pointed pseudopods and small neutral red-staining granules, and large stellate cells with anastomosing processes were found in both sexes. Besides these in female haemolymph was a third type of amoebocyte with broad blunt pseudopods and large round neutral red granules. These cells are identical with the amoebocytes found outside the ovarioles. Their granules are also like those in the young oocytes in size and staining affinity. Evidence favors the disintegration of the amoebocytes outside the ovarioles and

the transfer of their granules to the oocyte cytoplasm by the follicular epithelium.

These granules could not be demonstrated by ordinary fixation in smears or sections, but the Kopsch-Mann technique demonstrated that they were Golgi bodies. They appeared to be hollow black spheres and these probably contained the neutral red-staining material.

These results indicate that here may be the beginning of the yolk granules. This seems more probable than their origin from oocyte nucleolar material or from mitochondria.

33. Experimental data regarding the sympathetic innervation of skeletal muscles and its rôle in muscle tonus. ALBERT KUNTZ and ALVER H. KERPER, Saint Louis University School of Medicine.

Further experimental anatomical studies confirm our findings previously reported regarding non-medullated nerve fibers of small caliber, obviously of sympathetic origin, which terminate on skeletal muscle fibers and remain intact following complete degeneration of the somatic nerve supply. These findings corroborate the experimental anatomical findings of Boeke ('13) and others.

Curves of passive extension of the triceps brachii and quadriceps femoris muscles are presented which indicate a component of tonus in these muscles which is normally mediated through the sympathetic nervous system. The curves of the triceps brachii obtained following section of both roots of the spinal nerves (cervical 6, 7, 8) through which it receives its somatic innervation, leaving the sympathetic nerves intact, show that under these conditions the muscle is not without tonus. The curves both of the triceps brachii and quadriceps femoris, obtained following elimination of their sympathetic nerve supply, show marked reduction in the tonus of these muscles due to loss of their sympathetic innervation.

The component of tonus which is mediated through the sympathetic nerves is probably plastic in quality.

34. The cerebellum of reptiles: lizards and snake. O. LARSELL, University of Oregon Medical School.

The cerebellum of Anniellidae, Iguanidae, Anguidae, and of the garter snake has been studied from the viewpoint of structure in correlation with the methods of locomotion of the several species.

In Anniella the cerebellum is very simple and represents considerable degeneration, in the iguanid lizards there is an extreme specialization of the primitive type of cerebellum, while in Gerrhonotus, of the family Anguidae, the cerebellum shows affinities with the various groups of reptiles.

The cerebellum of lizards and snakes may be divided into a pars lateralis on either side and a pars interpositus between. The pars lateralis, highly developed in the iguanids, appears to be primarily concerned with the movements of the paired appendages, while the pars interpositus, well developed in the Anguidae and the snakes, appears to be concerned with the segmental muscles of the trunk and possibly the tail.

The deep cerebellar nuclei are present as a medial and a lateral group of cells. The afferent and efferent cerebellar fiber tracts, in general, are similar to those of mammals.

35 a. Macrophages of the deep fascia of the thigh of the rat in spreads supra-vitaly stained with neutral red and with janus green. WARREN H. LEWIS, Carnegie Laboratory of Embryology, Baltimore, Maryland.

The macrophages in this region are very abundant, but unevenly distributed. In the neighborhood of the fat-lobules, especially near the blood vessels, the larger ones (clasmatocytes) are most numerous. They are also scattered in the less vascular portions of the fascia often in short and long rows. In these areas macrophages ranging in size from large mononuclear blood cells to the clasmatocyte type are abundant and easy to see. One can easily select a perfectly graded series from mononuclears to the largest macrophage. When properly stained with janus green, it is easy to demonstrate that every macrophage contains abundant mitochondria. The largest ones have the greatest mitochondrial content. The evidence from such spreads is perfectly in accord with the idea that macrophages (clasmatocytes) come from mononuclear blood cells.

No evidence of any transition from either connective-tissue cells or endothelial cells was found in this locality. Occasional polymorphonuclear neutrophils were seen and some evidence of a transition from the polymorphonuclear to a mononuclear condition found especially in cells that had remained for several hours in the blood vessels.

Many places were noted where living connective-tissue cells were entirely isolated from their neighbors, no connections were observable even with the highest powers. The evidence from such spreads is against a syncytial relation of these cells.

35 b. Macrophages in sterile inflammation of the deep fascia of the rat. WARREN H. LEWIS, Carnegie Laboratory of Embryology, Baltimore, Maryland.

Shortly after the thigh is severely pinched, spreads contain many polymorphonuclears migrating in the fascia, and vessels are sometimes packed with them. Eighteen hours later, there are many migrating polymorphonuclears and many transition forms between them and the mononuclears and small macrophages. There is an increase in the number of macrophages; some contain ingested red blood cells. Most of the latter still retain their haemoglobin. At forty-eight hours, there is an enormous increase in the number of macrophages; some areas may be literally packed with them.

The usual idea of such invading polymorphonuclears is that they die, disintegrate, or become engulfed by macrophages. Undoubtedly, many are killed in infectious inflammations, but in this mild traumatic form they do not die. The multiplicity of transition forms leads to the tentative conclusion that many of them change into mononuclears and macrophages by swelling of the nucleus, which becomes less and less lobulated and finally non-lobulated. Neutral red staining granules accumulate and become concentrated about the centrosome. The film-like pseudopodia gradually encircle the entire cell instead of being only at the anterior end. Cells with small granules are epithelioid-like, those with larger bodies are macrophages or clasmatocyte-like. There is no indication that either the endothelial or connective-tissue cells take any part in the formation of mononuclears or macrophages.

35 c. *On the possibility of the transformation of polymorphonuclear leucocytes into mononuclears, epithelioid cells, and macrophages in cultures of the buffy coat of the blood of the rat.* WARREN H. LEWIS, Carnegie Laboratory of Embryology, Baltimore, Maryland.

Within twenty-four hours one can find many transition stages between the polymorphonuclears and the mononuclears. The typical migrating polymorphonuclears have the nucleus near the anterior end which is crowned by a tuft of film-like pseudopodia. Fine granules in brownian motion lie just in front of the nucleus. Posterior to it the granules are more numerous. These elongated migrating cells usually taper toward the posterior end. Contraction waves appear to pass anteriorly posteriorly. The stages between such cells and typical mononuclears indicate the following changes: 1) That the lobulated nucleus swells, gradually becomes less and less lobulated, and finally oval or indented. The nucleus is very plastic and continually changes shape during migration. 2) That there is a gradual accumulation of neutral red-staining granules, slightly larger than the neutrophilic ones, and a concentration of these about the centrosome into a central area. 3) That fat-globules accumulate about the central area one by one. 4) That the film-like pseudopodia gradually increase in extent until they more or less surround the whole cell. The polymorphonuclears tend to migrate in a jerky manner, the mononuclears at a more even pace. The transition stages show intermediate types of migration. The mononuclear forms change into epithelioid cells or into macrophages. We are now attempting to follow single polymorphonuclears minute by minute through all the phases of transformation into mononuclears.

36. *Histological absorption phenomena in the small intestine.* CHARLES C. MACKLIN and MADGE THURLOW MACKLIN, Medical School, University of Western Ontario.

Accumulations of vacuoles or spherules in the basal portions of the epithelium of villi of the small intestine, or between the epithelium and the basement membrane, have been described by Mingazzini and others and interpreted by some as an indication of the absorption of protein material and by others as the effect of shrinkage.

We have failed to observe this formation in villi from intestines containing products of digestion of meat and other proteins, provided fixation was done while the circulation was proceeding normally, or immediately after the cessation of free circulation. We have also failed to discover any traces of it by careful continuous observation with the high-power binocular microscope of the villi in the opened intestine of the living animal.

We have produced this phenomenon experimentally in various ways, as by killing an animal during digestion and delaying fixation for a short time; by injecting water and various solutions into loops of living intestine and tying off the blood vessels, etc.

We would therefore question whether this phenomenon occurs in normal absorption, and would suggest that it is due to accumulation of material absorbed by the epithelial cells, where its usual prompt collection and removal by the blood stream does not take place. We feel that the same explanation holds for the similar phenomenon described in the large intestine by Bremer.

37. *Pronounced dietary morphologic changes.* A. W. MEYER, Stanford University.

Adult guinea-pigs fed on an abundance of hay and grain alone succumb in six to eight weeks. If the grain is heated to 100°C. for one hour, in the presence of air, they die much sooner, although the heating does not appreciably change the gross physical nature of the grain.

All necropsies revealed some lesions regarded as characteristic of scurvy and a very few pigs out of several hundred also showed some postural signs of scurvy.

The most surprising anatomic change is an almost complete fatty degeneration of the liver and a marked fatty degeneration of the adrenals and kidneys. This fatty degeneration is associated with a decided general autolysis resulting in extensive destruction in both voluntary and involuntary musculature, the glands, lungs, osseous and nervous systems, and the alimentary tract, ovary, etc.

The endothelium of the blood vessels becomes swollen and detached and even the walls of the vessels become deficient.

The fatty degeneration probably is secondary to the lytic change due to subsistence on this deficient diet. This may have caused the increased permeability of the vessels, absorption, especially at the chondro-osseous junctions, and the general dissolution. Yet animals can be rescued within six to eight hours of death by change in the diet, provided they will still eat.

38. *A graphic study of the measurements of the greater and lesser diameters and the nuclear diameters of liver cells from normal and underfed albino rats.* SHIRLEY P. MILLER, Department of Anatomy, University of Minnesota.

These graphs indicate that extreme care should be used in interpreting averages of series of measurements dealing with changes in cell size.

39. *Evolution of man's erect posture.* DUDLEY J. MORTON (introduced by H. S. Burr), Department of Surgery, Yale University, Research Associate, American Museum of Natural History, New York City.

Definite physical laws which determine the position and stability of inanimate objects according to the relationship of their weight center to the supporting base apply also to posture as habitually assumed by different forms of organic life. Comparative studies of modern vertebrates demonstrate that the posture of terrestrial bipeds and quadrupeds is absolutely dependent upon the physical characteristics of the locomotor apparatus.

Man's erect posture is the direct result of a sequence of evolutionary changes which, by aid of present paleontological evidence, can be traced from the earliest appearance of terrestrial vertebrates. The principal factors which have been associated with various divergences in posture from that of the primitive pronograde tetrapod are, 1) gross morphological alterations in somatic growth which have changed the position of the body's center of gravity; 2) adaptations of limb structures for different methods of locomotion, and, 3) higher grades of neurological control of musculature. Analysis of the inevitable interaction between gravity and organic structures which have characterized successive evolutionary stages, definitely substantiates man's derivation from an ancient anthropoid-ape stem, and indicate that he has been in all essentials an erect terrestrial biped from the very time of his origin and never passed through a semierect stage as manifested in the modern apes.

40 a. *Amputation of the developing limb in rat embryos from the eleventh to the fourteenth day of age.* J. S. NICHOLAS, Department of Anatomy, School of Medicine, University of Pittsburgh.

Experiments reported previously have shown the method of approach to mammalian embryos and have further shown that, so far as the limb is concerned, there is no potency for its regeneration after the fourteenth day of development.

In order to further delimit the times of organization of materials, amputation experiments have been performed earlier in the embryonic cycle. Amputations were made by cutting, ligature, and cautery. The site of amputation was varied. The shoulder-joint, elbow-joint, wrist-joint, and the digits formed the sites of operation. The operations afforded both irregular and regular surfaces.

In no case so far examined in a series of sixty-four individuals has there been regeneration of amputated parts. There is healing upon the site of the wound, proliferation and growth of the proximal stump.

Eighteen animals in this series were permitted to continue development to birth. Of these eighteen, fourteen animals were born alive at the close of the normal gestation period. Four were resorbed, due to the physiological state of the mother.

The period during which the embryo has power to regenerate parts lost by operation, such as the limb, must be limited to a time in development preceding the above stages.

40 b. *The reactions of the developing limb girdle in response to rotation of embryonic rudiments in *Amblystoma punctatum*.* J. S. NICHOLAS, Department of Anatomy, School of Medicine, University of Pittsburgh.

Experiments previously reported have shown that, when a $3\frac{1}{2}$ -somite transplant is used, the developing limb undergoes regulation in posture after varying degrees of rotation whether heterotopically or orthotopically transplanted. Further study has shown that when a 5-somite transplant is used, there is no postural regulation. The limb develops in its transplanted orientation irrespective of its orientation to the embryo as a whole.

The girdle parts which develop from the area surrounding the limb bud, i.e., included in the 5-somite transplant, but absent in the $3\frac{1}{2}$ -somite graft, are the main portions of the suprascapula, coracoid, and procoracoid. They act as determining factors in the orientation of the girdle portions included with the usual $3\frac{1}{2}$ -somite graft and determine the posture of the grafted limb. The displacement occurring in the orientation of the developing girdle parts agrees closely with the degree of rotation of the transplant. The entire transplant develops as a unit which initially is independent of the host for its orientation.

If the period of observation of such an animal is continued from sixty to ninety days after the operation, a partial regulation of the shape of the girdle is found. The processes which underlie this form of girdle regulation are hyperplasia of the various girdle elements with subsequent resorption of parts originally formed.

While the girdle undergoes regulation in orientation which simulates the normal orientation, the limb remains abnormal in posture.

41. *A quantitative study of the testicle of the foetal pig.* H. L. OSTERUD and K. F. BASCOM, Department of Anatomy, Medical College of Virginia.

The prenatal development of the testicle of the pig seems to be roughly divisible into three periods: the first characterized by the establishment of the sex cords, the second by their attainment of maximum prenatal diameter, and the third by a great increase in their total length without perceptible increase in their diameter. The following figures are stated in round numbers.

At the beginning of the third period the pig has attained a crown-rump length of 11 cm. and a body weight of 65 grams. The weight of its testicle is 15 mgm. A foetus having a crown-rump length of 25 cm. and a body weight of 700 grams has a testicle weighing 85 mgm.

While testicular weight has thus increased six times, the volumetric ratio of sex cords to interstitial tissue (1 to 3, respectively) has remained unchanged; that is, for every cubic millimeter of increase in sex-cord volume there is an increase of 3 cu.mm. in the volume of interstitial tissue. The striking constancy of this ratio, which appears even during the second period of testicular growth, indicates the possibility of a significant interdependence between sex cords and interstitial tissue, based upon quantitative factors.

During the third period of prenatal testicular growth, the total length of the sex cords increases from 1 meter to 8 meters. Throughout this growth in length, the average diameter of the sex cords remains almost constant at 56 μ .

42. *The rôle of the dorsal roots in muscle tonus.* S. W. RANSON, Washington University Medical School, Saint Louis.

The dorsal roots play a more complex part in the maintenance of muscle tonus than was formerly supposed. It is said that section of the dorsal roots causes atonia, because it interrupts the proprioceptive reflex arc. If, however, the long dorsal roots of the lower lumbar and sacral nerves of one side are cut close to the cord, atonia seldom develops. The deafferented muscles become markedly hypertonic and remain so for months. Atonia occurred regularly in our experiments only when the spinal ganglia were damaged.

These observations indicate that the spinal ganglia and the peripherally directed fibers which take origin there are more important for muscle tonus than are the centrally directed branches of the sensory neurons. It is possible that the tonic impulses which have been shown to pass through synapses in the spinal ganglia are relayed to the muscles antidromically along the sensory fibers and that axon reflexes play an important part in muscle tonus. The conception of axon-reflex tonus necessarily carries with it the assumption that there are also nerve fibers which inhibit tonus. It may be that the persistent hypertonus obtained in our experiments was due to axon reflexes freed from the inhibitory control of the central nervous system by the section of antitonic fibers in the dorsal roots.

43. *A quantitative study of the literature of human developmental anatomy.* RICHARD E. SCAMMON, Department of Anatomy and Institute of Child Welfare, University of Minnesota.

The study of the growth and structure of the human body in the interval between the early (embryonic) period of development and maturity is greatly

hampered by the lack of an adequate colligation of the literature. An attempt has been made to analyze a part of this published material on the basis of a bibliography of some 5500 titles. Approximately one-twentieth of these publications appeared before 1850, one-twentieth between 1850 and 1859, two-fifths between 1859 and 1899, and about one-half since 1900. Nearly one-half were published in German, nearly one-fifth in both French and English, and the remainder in various languages, including about 5 per cent in Latin. Nearly one-fifth appeared in journals of the fundamental medical sciences, and slightly less in general medical journals. About 5 per cent have appeared in pediatric journals, and nearly 500 theses have been published on subjects in this field. About one-third of these publications deal with general body growth, about one-fourth each with skeleton and musculature, circulatory system, and digestive and respiratory tracts. About 5 per cent are concerned with the nervous system, 2 per cent with the urogenital system, and about 5 per cent with the ductless glands.

44. *The true supernumerary maxillary sinus.* J. PARSONS SCHAEFFER, Daniel Baugh Institute of Anatomy of the Jefferson Medical College.

True supernumerary maxillary sinuses and ethmoidomaxillary cells (sinuses) are not the same. Only in the restricted sense that all of the paranasal sinuses have their beginning in the stomaxial field is the grouping together permissible. True supernumerary maxillary sinuses are rare, ethmoidomaxillary cells common. Embryologically, ethmoidomaxillary sinuses are derived from the superior nasal meatus, rarely from the supreme meatus. True supernumerary maxillary sinuses develop from the depth of the ethmoidal infundibulum and in the adult always communicate with it, points in accord with the genesis and adult anatomy of the maxillary sinus proper. It would appear that never does a supernumerary maxillary sinus develop from the region of the accessory maxillary ostium. The accessory ostium is of secondary formation. Illustrations will be presented of this rare but clinically important variation of the maxillary sinus. The embryology and gross anatomy will be considered.

The clinical importance of the supernumerary maxillary sinus and the ethmoidomaxillary sinus cannot be overstated.

45. *A note on the development of the radial artery.* H. D. SHENON, Bellevue Medical College, New York University.

In embryos of about 21 mm., a recently developed branch of the axillary artery crosses over the medial root of the median nerve and reaches the hand, occupying in the forearm the position of the radial artery. In such embryos the primitive axillary artery is still recognizable as representing the axillary and axillary part of the ulnar artery above the origin of the common interosseous, the common interosseous and the volar interosseous continued as its volar recurrent branch. The median artery, the dorsal interosseous, and the remaining part of the ulnar have been present also since the stage of 14 mm.

The newly developed branch of the axillary anastomoses with a branch of a more distal part of the axial, which occupies the position of the radial recurrent and marks the termination of the brachial artery in the hand. The part of

the longitudinal artery proximal to the anastomosis has usually disappeared at the stage of 23 mm., while the distal part persists to become the radial. The proximal (superficial brachial) part of the artery may persist, however, and compete with the (deep) brachial part of the axial for the supply of the forearm and hand. Many varieties of outcome have been recorded, the mechanism of origin of which is now being studied.

46. *Ablation and transplantation of the hypophysis in the rat.* PHILIP E. SMITH, Department of Anatomy, University of California.

I have developed an approach to the hypophysis in the rat which permits the ablation of either the entire gland or only the posterior lobe without apparent brain injury. This approach leads into the nasal cavity beneath the pituitary, and does not enter the buccal cavity. After trephining through the sphenoid and opening the dural sheath, the ablation can be effected by means of a cannula and negative pressure. The dural capsule of the gland, except for the small ventral opening, and the pituitary stock remain intact.

An almost complete growth stasis and a rapid regression in the size of the adrenals (involving chiefly cortex), the thyroids, and sex apparatus, with accompanying structural modifications, result from the removal of the anterior and posterior lobes. This syndrome differs from that produced by injury to the tuber cinereum, the most pronounced feature of which is profound adiposity and a sexual atrophy. With posterior-lobe ablation alone, the growth rate, sex apparatus, adrenals, and thyroids are normal.

Daily transplants (intramuscular injections) into pituitariless rats of the fresh rat pituitary bring about a nearly normal growth rate, as do injections of saline extracts of the bovine anterior hypophysis as prepared by Evans and Long. In addition, these transplants effect a partial repair of the adrenals, thyroids, and sex glands.

47. *Studies of hyperthyroidism. III. Bile-pigment production and erythrocyte destruction in thyroid-treated amphibian larvae.* C. C. SPEIDEL, University of Virginia.

Experimental hyperthyroidism in urodele larvae (*Amblystoma*) and anuran larvae (*Rana*, *Bufo*, and *Hyla*) is accompanied by definite changes in bile color. The normal pale green color of the full gall bladder changes progressively after thyroid administration to a brighter green, then emerald-green, and finally a very dark green.

The bile pigment, biliverdin (and its derivatives), is elaborated from the hemoglobin of worn-out erythrocytes. Thyroid administration induces an increased rate of erythrocyte destruction, and this is followed by an increased output of bile pigment. Other minor factors are mentioned which may to a limited extent modify the color of the bile.

Erythrocyte destruction occurs largely by enucleation, cytoplasmic segmentation, and fragmentation, and is probably widespread in the body. Many fragments and senile red cells collect in the liver. During the later stages of thyroid treatment, the macrophages become conspicuously active. They are especially abundant in the liver, the gut, and the gills. In addition to the hemoglobin

eliminated after transformation into bile pigment, some is transported by macrophages through the gut lining, and to a less extent through the involuting gill epithelium, and thus eliminated from the body.

48. *Stria terminalis and amygdaloid complex in the opossum.* H. B. VAN DER SPENKEL (introduced by C. Judson Herrick), Department of Anatomy, University of Chicago.

The stria terminalis, swinging around the internal capsule, connects a medial field with the amygdaloid nuclei. It consists of five bundles, described by Johnston, with separate origins and terminations.

Bundle 1, crossing in the anterior commissure, connects the nucleus tractus olfactorii lateralis of the two sides. Some of its fibers probably go to the claustrum.

Bundle 2 connects the lateral gray of the bed nucleus (Johnston) with the nucleus centralis and medialis amygdalae.

Bundle 3 connects gray under the anterior commissure and far forward medially in the precommissural area, with nuclei lateralis and basalis accessorius and massa intermedia amygdalae.

Bundle 4 connects the parolfactory region and gray in front of the anterior commissure with nuclei basalis and basalis accessorius II and perhaps also the hindmost part of nucleus corticalis.

Bundle 5 accompanies the stria medullaris and, combined with a tract descending from the habenula, turns around the capsule to connect with nuclei perichiasmaticus, medialis amygdalae, tractus olfactorii lateralis, tuberculum olfactorium. Some habenular fibers may connect with the hippocampus.

According to stria connections, the amygdala is divisible into a lateral part connecting with bundles 3 and 4: nuclei lateralis, basalis, basalis accessorius, corticalis; and a medial part connecting with bundles 1, 2, 5: nuclei tractus olfactorii lateralis, centralis, medialis. These are separated by the massa intermedia amygdalae.

49. *A comparison of the Miller embryo with other young human embryos.* G. L. STREETER, Department of Embryology, Carnegie Institution of Washington.

When the human ovum becomes implanted, its trophoblastic shell is more precocious and is undergoing more active differentiation than the inner cell mass, or embryo proper. This rapidly changing trophoblast thus presents better criteria for determining the relative development of ova than can be recognized in the slowly differentiating inner cell mass. In the Miller specimen the trophoblast is just arranging its syncytial streamers in the form of lacunae. In the Kleinhans (Grosser) ovum these lacunae have become flooded with blood. In the Teacher-Bryce I the blood-saturated syncytium has encroached on maternal tissues, producing a necrotic zone, and the surrounding endometrium has undergone decidual transformation. These three ova thus constitute successive stages, and in that order of development. The embryo 'Sch.' of von Möllendorff is characterized by a trophoblast much like that of the Teacher-Bryce I, and is probably of about the same age.

50. *The lateral aperture of the fourth ventricle in man.* R. M. STRONG, LOIS D. GREEN, and J. V. OLIVERIO, Department of Anatomy, Loyola University School of Medicine.

Evidence supporting the view that there are real openings connecting the fourth ventricle with the subarachnoid space has been obtained. A series of sections of the adult human brain stem, including structures bounding the fourth ventricle, was studied. The work involved the preparation of a wax model. The lateral recess is mostly narrow and somewhat tortuous. The aperture is well defined, histologically, and a tuft of choroid plexus protrudes into the subarachnoid space, as shown in various text-books.

51. *The nucleus and tract solitarius in man.* R. M. STRONG and T. H. MADAY, Department of Anatomy, Loyola University School of Medicine.

Two series of adult human brain-stem sections, belonging to the department, were studied. A wax model was made which includes some of the connecting nerve fila. Only an approximate location of the nucleus was possible. No commissure and no rostral swelling were found.

52. *The effect upon mammalian heat production of feeding thyroid of cold-blooded vertebrates.* W. W. SWINGLE, Osborn Zoological Laboratory, and KIRBY MARTIN, Department of Internal Medicine, Yale University.

Acting upon the idea that possibly the thyroid hormone of cold-blooded forms lacks chemical groupings concerned with heat production in mammals, we performed the following experiments:

One normal adult was fed 5.3 grams of mammalian thyroid of standard iodine content. A 21 per cent increase in basal metabolism resulted, accompanied by marked subjective symptoms.

Six adults were fed 5.3 grams of sea-turtle thyroid of high iodine content. The effect on heat production was negligible.

Three individuals received 5.3 grams of alligator thyroid of high iodine content. Two showed no change in heat production, one a 15 per cent rise.

Three myxoedematous individuals (basal metabolism—20) received 5.3 grams reptile thyroid. All showed changes in heat production comparable to the control fed mammal thyroid. Occasionally such individuals show similar rises on iodides alone, indicating that iodine introduced into certain individuals with hypofunctioning glands may be rapidly utilized.

Turtle and alligator thyroid administered to rabbits in doses equivalent to five times that employed by us for humans increased the heat production.

The experiments indicate a quantitative difference in the thyroid hormone of cold- and warm-blooded vertebrates with reference to the constituents responsible for heat production in mammals. Reptilian thyroid is less active than that of mammals.

53. *Evidence of free fluid in the pulmonary alveoli.* R. J. TERRY, Washington University.

An experiment has been carried out, chiefly upon cats, by which an appreciable amount of clear fluid has been recovered directly from the air spaces of

the lung. The animal is anaesthetized by an intraperitoneal dose of amytal, an insufflation tube inserted into the trachea, and a small area of the parietal pleura in the fifth intercostal space exposed. Capillary glass tubes driven through the pleura into the lung fill with columns of blood and of a clear fluid containing bubbles. When the pleura is opened and the lung kept moderately inflated, tubes inserted into the superficial alveoli may be seen under the binocular microscope to be filled by clear fluid rising from the superficial air spaces. This fluid has shown a faint reaction to Esbach's reagent, none to acetic acid; it rarely contains formed elements of the blood (leucocytes).

54. *The stomach of the medical student.* T. WINGATE TODD, Western Reserve University.

The medical student makes a good normal upon which to define the modal positions and contours of particular parts of the stomach as well as of the intestines.

The small intestine is largely in the true pelvis, and only a single loop is ever above the pylorus.

So-called duodenal stasis may be present for an hour or more without any anomalous or pathological condition.

The stomach, though changing position with alteration in body posture from vertical to horizontal, does not change its shape.

The sites of pylorus, greater curvature, and even of cardia vary with the psychic and constitutional condition of the student. Roentgenograms taken of a student at different times during his medical course illustrate this observation very clearly. Differences in social status (e.g., between the medical students on the one hand and the patients in a free hospital clinic on the other) seem to be associated with differences in modal position of these parts of the stomach.

The type of peristalsis (rapid or slow, vigorous or superficial) apparently bears no relation to rapidity of emptying of stomach.

55. *The secretion process in the living thyroid gland.* E. UHLENHUTH, University of Maryland.

Larvae and metamorphosed animals of two species of salamanders, *Amblystoma maculatum* and (probably) *A. jeffersonianum*, mostly after having been stained vitally with neutral red, were anesthetized and their thyroids removed, to be examined immediately under the microscope. The colloid does not stain and chromophile and chromophobe colloid cannot be held apart.

In the thyroids of metamorphosing animals vacuoles are very distinct. Large intracellular vacuoles are present in the cells. Numerous colloid vacuoles are found in the follicular lumen, closely attached to the apical cell walls or in open communication with the cells which excrete them. The peripheral ends of the intercellular spaces are filled with vacuoles. Extrafollicular vacuoles are frequently present in large numbers, attached to the follicular periphery.

In early larval stages none of these vacuoles are present. Intracellular vacuoles are few throughout larval life, colloid and intercellular vacuoles increase in number toward metamorphosis. All vacuoles are conspicuously increased in number during metamorphosis.

One of the thyroid secretions is elaborated in intracellular vacuoles which are excreted into the follicular lumen. The nature of the intercellular and extra-follicular vacuoles is not clear. They may contain the same or another secretion. The extrafollicular vacuoles may be the excreted intercellular vacuoles.

56. *Degeneration and regeneration of the seminiferous tubules after ligation of the ductuli efferentes in the rat.* GERTRUDE VAN WAGENEN, University of California.

In contrast to vas ligation, the ligation of the proximal ends of the ductuli efferentes is followed by a prompt and profound degeneration of the germinal epithelium. Twenty-four hours after ligation, there is an evident rise in intraglandular pressure. Histological examination at this time shows an increase in the lumen and diameter in each seminiferous tubule. If the ligation is made at the surface of the gland the degeneration is maximal at twenty-one days and the seminiferous tubules are devoid of contents except for a reticulum and a few scattered cells as in the cryptorchid testis. Examination of glands at the end of one, two, or three months may still show this uniform degeneration; but after the lapse of five, six, or seven months, some spermatogenesis is re-established and a few tubules in the cross-section of a gland contain normal germinal epithelium with spermatids and spermatozoa.

57. *Observations upon nerve regeneration in live tadpoles.* S. CULVER WILLIAMS (introduced by Ross G. Harrison), Yale University.

Larvae of *Rana sylvatica* anesthetized in solutions of urethane or chlorotone in tap-water may have the sensory nerves of the tail fin stained by application of 1 per cent methylene blue to the punctured surface of the skin. Axis cylinders in this region become bright blue, the color spreading rapidly along the nerve to include the finest branches.

Medullated nerves in the tail fin were cut; after twenty-seven to ninety-three hours they were stained in vivo, observed, and drawn. Typical wallerian degeneration of distal parts ensued in every case, although sheath degeneration may sometimes cease upon the entrance of a new regenerating axone. Fifteen cases showed that new outgrowing axones which entered the old degenerating sheath grew in length about three times as rapidly as those which grew elsewhere. Attempts to influence regenerating axones by the introduction of glass tubes, hair, vegetable fibers, and degenerating sciatic nerve, under the skin, gave consistently negative results.

PAPERS TO BE READ BY TITLE

1. *A study of the parietal fontanelle in the newborn and infant.* FRED L. ADAIR and RICHARD E. SCAMMON, Departments of Obstetrics and Gynecology and of Anatomy, and Institute of Child Welfare, University of Minnesota.

The parietal or sagittal fontanelle has been studied in living infants by a special tracing method. About 500 newborn children and infants of the first two years were examined. Membranous gaps were encountered along the course of the interparietal portion of the sagittal suture in over one-quarter of the

younger infants. In between 4 and 5 per cent, these spaces were 1 sq.cm. or more in area (as determined from tracing with the polar planimeter). The average area in infants of the first two weeks is about 1 sq.cm. No parietal fontanelles were found after the sixth postnatal month. The parietal fontanelle appears to arise either independently (probably as a result of persistent double ossification centers of the parietal bones) or by extension from the frontal fontanelle. It is possible that it may also arise as extensions of the occipital fontanelle in rare instances.

2. *Progress of work on the mechanism of the menstrual cycle of the monkey, Macacus rhesus.* EDGAR ALLEN, University of Missouri School of Medicine (assisted by a grant from the Committee for Research on Sex Problems of the National Research Council).

Both ovaries have been removed from five monkeys. In two operated on the tenth and fourteenth days of the cycle, ovulation had occurred and unfertilized ova were recovered from the tubes.

In three monkeys the ovaries were removed and in another the large follicles were injured towards the end of, or immediately after, the follicular phase of the cycle. Apparently typical menstrual bleeding began on the fourth to sixth days following this operative removal of ovarian hormonal influence. Reddening and swelling of the vulva and surrounding regions disappeared after double ovariectomy.

Ten series of injections of ovarian and placental extracts have been completed in five spayed monkeys. From 78 to 138 rat units of hormone were injected over periods varying from nine to twenty days. Typical reddening and swelling of the vulva and surrounding regions were induced. Disappearance of leucocytes and growth of the vaginal epithelium to the point of cornification were indicated by smears of vaginal contents. Considerable growth was induced in the uterus. In five of eight series bleeding followed discontinuance of injections in three to seven days. The duration of these experimental menses varied from one to three days. The flow was scant, but characteristic. No bleeding occurred during the period of injections, and none followed two series in an animal from which the uterus had been removed.

3. *Effect of placental and follicular extract upon the phenomena of oestrus, with special reference to the mammary glands (opossum).* E. ALLEN, University of Missouri; CHARLES DUPRE, University of Texas, and CARL HARTMAN, Carnegie Laboratory of Embryology, Baltimore.

Since the opossum has been shown to exhibit oestrous phenomena, of which the mammary hypertrophy is a striking feature (Hartman, '23), this form seemed particularly adapted to studying the effect of growth hormones on mammary glands, as well as further to test the species non-specificity of the hormones. 0.5 to 1.5 cc. of oil containing the hormone (Allen and Doisy, '23 ff.) was injected hypodermically twice daily for about a week into castrated mature females, whose mammary glands (if previously enlarged) had involuted beyond detection by palpation (Hartman's method). Placental extract was prepared from ripe human placentae, follicular extract from the sow.

Results with placental extract (seven experiments): One case was negative (the placenta not extracted fresh); two cases showed development of reproductive organs as in pseudopregnancy of several days' standing: greatly hypertrophied mammae, large uterus with convoluted glands, cornified vagina with pronounced leucocytosis. The other cases reached stage normally attained at oestrus: mitoses in uterine glands and alveoli of mammae, swelling of genitalia, cornification of vaginal epithelium (latter somewhat atypical, as in intact animal possessing atretic follicles).

Results with follicular extract (five experiments) practically as in the less pronounced cases of preceding group (two cases) or a little less advanced, i.e., as in late prooestrus. In eleven experiments castration atrophy was thoroughly corrected.

4. *Preliminary analyses of the tissues and of the metabolism of animals suffering from dietary sterility.* EVELYN M. ANDERSON (introduced by H. M. Evans), University of California.

A remarkable similarity exists between the blood of animals fed natural foods and the blood of those fed on sterility-producing diets. The administration of vitamine E, in the form of wheat-germ oil, during pregnancy gives no definite change in the blood as measured by total solids, red blood cells, inorganic phosphorus, lipid phosphorus, cholesterol, or total lipoids. Female rats on a low E diet may have a first litter before becoming sterile. These young have been analyzed at birth for crude protein, total lipoids, and ash. For a comparison, newborns from the stock colony were also analyzed. Although natural-food newborns weigh about 1.5 grams more than those from pure food mothers, the moisture content is almost identical (85 per cent) and the crude protein plus total lipoids plus ash account for only 73.4 per cent of the total solids, while the same constituents account for 91.5 per cent of the total solids of the newborns from pure-food mothers. No relation to sterility is suggested. A study of nitrogen and fat metabolism on pure-food diets, with and without a wheat-germ-oil supplement as a source of vitamine E, has revealed no differences which could account for the fertility of the mother receiving E.

5. *Moisture determinations of the total tissues of normal rats and of those deprived of vitamine A.* EVELYN M. ANDERSON (introduced by H. M. Evans), University of California.

The entire bodies of nine rats suffering from typical xerophthalmia and sudden growth decline due to absence of vitamine A and the bodies of nine normal control rats were thoroughly ground, the minced tissue uniformly mixed, and in the case of each individual duplicate samples taken for moisture determinations, made in a vacuum oven under uniform conditions. In all cases the total tissue from xerophthalmic rats had a higher moisture content (70 per cent) than did the tissues of normal rats (62 per cent). In view of the desiccation of some of the epithelia (cornea, vagina, bronchi), the results would appear to indicate that water is not diminished, but differently distributed in the two conditions.

6. *The time during which the mesonephros and the metanephros of the developing chick are able to store trypan blue.* WAYNE J. ATWELL and ERNEST B. HANAN. Department of Anatomy, University of Buffalo.

Using the method of injection of a solution of vital dye into the air sac of the incubating egg, it was found that the mesonephros begins to store trypan blue at the fifth day of development. This supports Boyden's statement that the mesonephros is a functional organ early in development. Probably the reason that we have not been able to find dye in the mesonephros in the fourth day of incubation is the fact that the respiratory vascular net does not come into contact with the air sac until the fifth day.

The cells of the metanephros begin to store the dye at eleven days of incubation. The mesonephros retains its ability to store dyes until two or three days prior to hatching.

If ability to store dyes may be taken as an indicator of normal functional activity, the mesonephros is functional at the time the respiratory vascular net reaches the air sac and continues to be the sole embryonic excretory organ until eleven days. From eleven days to eighteen or nineteen days of incubation, mesonephros and metanephros both function; thereafter, the metanephros alone.

7. *Absorption from the vagina of the albino rat at various periods of the oestrous cycle.* DAN D. BAKER (introduced by Edgar Allen), University of Missouri, School of Medicine.

There is a great variation in the thickness of the vaginal epithelium of the rat during the oestrous cycle. This ranges from four to seven layers of cells during the dioestrus to more than fourteen layers plus a cornified layer during oestrus. During the metoestrus much of this growth is sloughed off and infiltrated by leucocytes which apparently cytolyse the epithelial cells. There is little indication that this material passes to the exterior. Is it absorbed through the vaginal walls?

This question was investigated by testing the urine for the presence of potassium ferrocyanide which had previously been introduced into the vagina. The urine was sampled through a suprapubic incision and tested for ferrocyanide with ferric chloride. During the operation the animals were lightly anaesthetized with ether and chloroform. The stage of the oestrous cycle was determined by examination of vaginal smears and the degree of vascularity of the uterus when the abdomen was opened.

Results have been obtained from thirteen normal rats. The average time for absorption during the dioestrus interval was thirty-five minutes, while near the time of oestrus it was fifty minutes. The results suggest that the absorption time varies during the cycle directly with the thickness of the vaginal wall. Study of this problem is being continued.

8. *On the distribution of the supracondylar process in the feeble-minded.* L. D. CADY and B. F. FRANCIS (introduced by R. J. Terry), Washington University, St. Louis.

Evidence has been presented in several publications implying a greater frequency of the supracondylar process of the humerus among the insane than in

York City. Only the observations on infants of Irish-Irish, Russian-Russian, and German-German parentage have been used and statistically treated with respect to sex and nationality.

The mean occipitofrontal diameter exceeds the mean biparietal diameter by about 2 cm. The absolute variabilities of the two head dimensions, expressed in terms of the standard deviation, are essentially the same. The relative variabilities, expressed in terms of the coefficient of variation, show the occipitofrontal measurement to be less variable than the biparietal. The means of the occipitofrontal and biparietal dimensions are somewhat larger in the case of the male than in the case of the female infants. The infants of Irish parentage apparently have larger head dimensions than either those of German or Russian extraction.

The coefficients of correlation measuring the relationship between the body length and the occipitofrontal dimension of the head are generally higher than those measuring the relationship between the length of the body and the biparietal dimension. The correlation coefficients of body weight and the two head dimensions are of the same general order of magnitude as those for body length and the head measurements.

12. *Quantitative studies on the human prenatal hypophysis and hypophyseal fossa.* WALTER P. COVELL (introduced by A. T. Rasmussen), Department of Anatomy, University of Minnesota.

From a study of ninety-eight hypophyses and fifty hypophyseal fossae of prenatal life, empirical formulae expressing the growth changes in dimensions and weights were developed.

The embryonic and early fetal growth of the gland follows the course of a shallow concave curve which rises rapidly in specimens of 50 to 100 mm. (crown-rump). The growth changes in weight for the fetal period may be similarly expressed. Weight begins to increase rapidly in fetuses of 30 to 35 cm. (crown-heel) and continues to birth. The growth changes in lineal dimensions of the hypophyseal fossa and the whole gland show a gradual increase and may be numerically expressed in terms of straight-line formulae.

The epithelial portions comprise relatively more of the gland in early prenatal development than later, while the pars nervosa gradually increases in relative volume. The hypophysis of a full-term fetus is roughly 78 per cent pars anterior, 2 per cent pars intermedia, and 20 per cent pars nervosa.

During the latter half of the fetal period approximately 71 per cent of the cells of the pars anterior are chromophobes, 6 per cent are basophiles, and 23 per cent are eosinophiles. The average nuclear diameters of the three types of cells are as follows: 5.2 μ , chromophobes; 5.5 μ , eosinophiles, and 6.0 μ , basophiles.

13. *The developmental arrangement of hair follicles.* C. H. DANFORTH, Department of Anatomy, Stanford University.

The development of hair follicles suggests problems similar to those presented by other structures that are repeated in the same individual. Since such structures are probably not individually determined by special precursors in the germ

plasm, interest centers in conditions regulating their appearance. One of the questions that arises in this connection is whether the skin is uniformly potential or is differentiated into areas of greater and lesser pilogenic potentiality. This has been studied in the mouse where hair follicles are produced during late foetal and early postnatal periods. The maximum rate of production occurs after birth when, for a few days, the relative ages of different follicles can be determined by their respective sizes. Evidence obtained from this critical stage indicates that the skin of the back has a generalized capacity for producing follicles, but that each follicle during development creates a negative zone immediately surrounding it. New follicles appear at the intersection of these zones. Their earliest arrangement may be represented as 143424341, where 1 represents the oldest, 4 the youngest follicles. It is not 12344321. The interaction of pilogenic and inhibitory forces results in a geometrical arrangement of hairs which might suggest, but probably has no significant relation to 'reminiscent scales.'

14. *Further observations on the epiphyses of the albino rat with special reference to the short bones.* ALDEN B. DAWSON, Department of Biology, New York University.

The primary elements of the innominate are practically united by the end of the third month. During the fifth month the coracoid becomes united to the body of the scapula.

Centers of ossification for the acromion, posterior angle of the scapula, iliac crest, ischial tuberosity, and posterior border of the ischiopubic ramus appear in the fifth month. These elements were not united to the bodies of their respective bones in the oldest animals examined (1270 days old).

True bony epiphyses were not found in several bones. None of the sternebrae, with the exception of the caudal end of the manubrium and cranial end of the second, possess bony epiphyses. The epiphyses for the heads of the ribs are also unossified. The epiphyses of the centra of the vertebrae exhibit considerable variation. Cervical and anterior thoracic centra usually lack bony epiphyses. Posterior thoracic and anterior lumbar centra possess bony epiphyses at their caudal ends only, while posterior lumbar and caudal centra have well-developed epiphyses at both ends. In these locations, however, characteristic cartilage plates were present and persisted until senility.

At the pubic symphysis zones of definitely arranged cartilage were present and persisted until old age.

The cartilage plate of the costochondral junction is interrupted centrally at the end of the second year, but peripherally the plate persists in the oldest rats examined.

15. *Leucocytic reaction to intraperitoneal injection of blood serum from inanition animals.* V. E. EMMEL and M. H. STREICHER, University of Illinois, College of Medicine.

In a previous study (Anat. Rec., vol. 29, p. 397, 1925; also Am. Jour. Anat. (in press)), it was ascertained that the leucocytic reaction to acute inanition involves a change in the lymphocyte-neutrophile ratio characterized by a relative

increase of neutrophiles and a corresponding lymphocytic decrease. In the present investigation experiments were instituted designed to determine whether any changes could be shown to have occurred in the circulating blood in inanition provocative of this leucocytic reaction. The results at the present stage of the study may be summarized as follows: a) blood serum from rats under nutritive conditions intraperitoneally injected into another series of normal animals is unaccompanied by any definite change in the ratio of neutrophiles and lymphocytes; b) similar experiments, however, with blood serum from rats after five days' inanition was correlated with changes in the lymphocyte-neutrophile ratio in the injected rats comparable to that previously found in the inanition animals.

16. *Increased food consumption in pseudopregnancy.* HAROLD GOSS (introduced by H. M. Evans), University of California.

Female rats on pure dietaries were mated with vasectomized males after the average food consumption in weekly intervals had been carefully determined. The pseudopregnancy, characterized by the cessation of oestrous cycles for two weeks, was accompanied by sharply increased consumption of food—from 25 per cent to 50 per cent above normal. There is a corresponding increase in the body weight of pseudopregnant animals.

17. *A note on the 'true luschka ducts' and the 'Rokitansky-Aschoff sinuses' of the human gall bladder.* BÉLA HALPERT, Johns Hopkins Medical School.

A difference between two types of epithelial-lined structures occurring in the wall of the human gall bladder may be demonstrated by appropriate microscopic studies:

1. *Rokitansky-Aschoff sinuses*—'hernia-like outpouchings of the gall-bladder mucosa' (Rokitansky, '55); 'Luschka ducts' (Aschoff, '05); 'Aschoff ducts' (Shikunami, '09)—are the deeper outpouchings of the gall-bladder mucosa, which dip down into the muscularis or extend as finger-like processes through the muscular coat into the perimuscular layer. The presence and number of these outpocketings, as well as their shape, length, diameter, manner of penetration, etc., are found to be dependent on several factors such as: a) relative strength, development of the individual longitudinal oblique and circular muscle bundles and their arrangement to one another; b) number and size of vessels passing through the intermuscular spaces and their method of penetration; c) state of contraction of the gall bladder and any condition influencing its contractibility (especially pathological changes).

2. *True Luschka ducts.* Epithelial-lined structures occurring on either peritoneal or liver surface of the gall bladder. They have a wall of their own and they do not communicate with the bile ducts or the lumen of the gall bladder, but sometimes with one another. According to Luschka who described them first ('63), they are metamorphosed remnants of the embryonic liver anlage.

18. *The arrangement of folds in the pars descendens duodeni, with special reference to their relationship to the papilla of Vater.* BÉLA HALPERT, Johns Hopkins Medical School.

The arrangement of folds in the pars descendens duodeni were studied with special reference to their relationship to the papilla of Vater in specimens fixed in situ with 10 per cent formalin.

1. All characteristics (length, height, shape, etc.) of the plica longitudinalis duodeni were found to depend upon the relationship of the terminal portion of the choledochus to the pars descendens duodeni. 2. The papilla of Vater opened either at the posterior or at the medial wall of the duodenum and in all cases at the caudal end of the plica longitudinalis if the latter was present. 3. A single longitudinal or two slightly divergent folds starting at the papilla and extending downward were noted in several cases. 4. In one case the papilla of Vater was found drawn into the cavity of a congenital diverticulum of walnut size. Two slightly converging folds pointing toward the papilla were seen to dip into the small opening of the diverticulum. Seemingly, no duodenal content entered during life through this opening into the interior of the diverticulum, whereas any fluid injected into the bile ducts filled it, the overflow passing into the duodenum. 5. In several cases no circular plicae of any prominence were seen in the middle third of the pars descendens duodeni; the fold immediately above the plica longitudinalis and the first fold below the opening of the papilla being more prominent than any of the others.

19. *Absorption of vital dyes by the membranes of the chick embryo.* E. B. HANAN (introduced by Wayne J. Atwell), Department of Anatomy, University of Buffalo.

Trypan blue, trypan red, and potassium ferrocyanide have been utilized. When injected into the air sac prior to the outgrowth of the allantois, the dye is not absorbed by the tissues of the chick. As the allantois makes its appearance the respiratory vascular network absorbs the dye either directly from the air sac or from the albumen. The chick becomes vitally stained within one-half to three-quarters of an hour following the injection. The intensity of staining depends upon the amount of dye injected and the time the egg is allowed to incubate following the injection. The dye is localized in the embryo and the allantoic fluid, but the yolk and the amniotic fluid are negative.

Following the injection into the allantoic cavity the staining of the embryo is the same as when the dye is on the outside of this cavity.

Under conditions of the experiment, the dyes are not absorbed from the yolk sac.

20. *Two cases of pathological ovaries with death of fetuses in utero; adrenal cortex in ovary (opossum).* CARL HARTMAN, Carnegie Laboratory of Embryology, Baltimore, Maryland.

Removal of ovaries early in pregnancy causes collapse of uterus and death of embryos (Hartman, *Am. J. Physiol.*, '25). The following cases occurring spontaneously in wild animals corroborate the experimental findings.

No. 965, 1325-gram female. Received January 24, 1925. Killed January 27th. Right uterus had three hemorrhagic spots; ten dead fetuses; right ovary normal in size, but corpora lutea and follicles hemorrhagic. Left uterus normal in appearance; a single dead fetus; left ovary hypotypical, flat, small, pallid except for a single hemorrhagic corpus luteum. In sections all corpora lutea are seen infiltrated with polymorphs, as in the puerperium. Hypotypical ovary possesses perfectly preserved mass of adrenal tissue (cortex). Ovaries normal as to oogenesis during preceding oestrous period.

No. 972, 1518-gram female. Caught February 9, 1925, three unsegmented eggs, one two-celled egg recovered from left uterus 4.30 P.M., February 10th. It was calculated that six days two hours later the right uterus would contain embryos in early somite stage; it was actually found, however, to be flaccid and pallid, as in ovariectomized females, and to contain several moribund 1-mm. blastocysts and many unfertilized eggs (thirty-eight in all). The right ovary (not yet sectioned) proved unique among the many cases observed; it was large, anemic, the corpora lutea almost colorless, and many of them confluent in a most bizarre fashion.

21. Direct color photomicrography for reproduction of histological preparations.

A. B. HOEN and O. O. HEARD (introduced by George L. Streeter), Carnegie Laboratory of Embryology, Baltimore, Maryland.

Satisfactory results have been obtained by us with the method introduced by Mees (communication no. 50, Research Laboratory, Eastman Kodak Company) in the color reproduction of microscopic sections. Since more adequate color illustrations in our biological journals are needed, this brief statement is given of the technique used in making the reproductions demonstrated at this meeting.

Two negatives are made on Wratten M panchromatic plates, with proper color filters. For sections stained with hematoxylin and eosin, the Wratten and Wainwright A filter is used for the blue-printing plate and the B and C filters, in combination, for the red. Continuous tone-contact positives are made from these on fine ground plate glass, its surface having been sensitized with photoengravers' collodion emulsion. These positives can be retouched with lead pencil, but is not recommended. Screen negatives (150 lines to the inch, or finer) are then made and printed directly on lithographers' stone, zinc, or copper, from which the final two-color printing is done.

Furthermore, it is possible to make the screen or dot separation simultaneously with the color separation. Halftone photomicrographic negatives can be made in this manner for immediate production, thereby saving the cost of two operations in plate making and gaining detail in reproductions.

22. The behavior of the isolated uterus in the hypophysectomized rat. EDWARD W. JONES (introduced by Philip E. Smith), Department of Anatomy, University of California.

A study has been made of the isolated uteri of rats hypophysectomized by Dr. P. E. Smith, to determine the presence or absence of spontaneous contractions and the response to adrenalin and to posterior pituitary fluid. The profound atrophy which the uterus displays after hypophysectomy has been described by several investigators. The apparatus used was essentially that described by Kehrer.

The uteri of animals six weeks after hypophysectomy (the most recently operated animals used) displayed no spontaneous contractions, even though the recording lever was without a load. Immersion in Armour's posterior pituitary fluid failed to produce any contraction, nor did immersion in an adrenalin solution cause relaxation. Uteri of animals which have suffered the loss of the posterior lobe only displayed normal contractions and gave the usual response to posterior pituitary fluid and to adrenalin.

The uteri of pituitariless animals which have received daily transplants (intramuscular injections) of the fresh rat pituitary displayed a normal or increased amplitude of contraction, but a slow rate, approximating the oestrous type.

23. The innervation of arteries of the extremities. ALVER H. KERPER (introduced by Albert Kuntz), Saint Louis University School of Medicine.

The material used in this study was obtained from five dogs which had been subjected to operation. In three the left sympathetic trunk was removed from the fourth lumbar to the first sacral segment, inclusive. These animals were kept 75, 107, and 111 days, respectively, during which time all sympathetic fibers which grow out from ganglia of the sympathetic trunk to be distributed to the left hind leg must have undergone degeneration. In two the right femoral and brachial arteries were ligated and cut. These animals were kept forty-two and sixty-eight days, respectively.

Sections of the arteries on both sides were taken in all these animals, as low as the tibial and ulnar, and stained by the pyridin-silver method.

The nerves were well stained and fibers were found deeply embedded in the wall of the artery on the side on which lumbar sympathectomy had been performed. Intact nerve fibers were also found in sections of the distal portions of the femoral and brachial arteries which had been ligated and cut.

Although incomplete at the present time, this study indicates that nerve fibers are supplied to the femoral arteries and their branches directly from the aortic plexus as well as from the sympathetic trunks. Likewise, the brachial arteries and their branches also receive sympathetic fibers which join them via the somatic nerves of the fore limbs.

24. Cytology of the normal synovial fluid. J. ALBERT KEY, The Shriners Hospital, St. Louis, Missouri.

The normal joint fluid of man, rabbits, and other laboratory animals was found to contain from 75 to 350 nucleated cells per cubic millimeter. In most of the fluids examined the cell count ranged from 225 to 275. Erythrocytes were also constantly present in about the same numbers. Differential counts of the nucleated cells were made by means of supravital staining. The average for fifty fluids was monocytes 58 per cent, clasmatoocytes 15 per cent, indeterminate macrophages 14 per cent, primitive cells 1 per cent, leucocytes 5 per cent, and synovial membrane cells 3 per cent. Occasionally there was considerable variation in the different joints of the same animal, but in all instances 85 per cent or more of the cells were macrophages.

The macrophages were in a state of stimulation. The monocytes were non-motile, averaged larger than those of the blood, and contained more neutral red granules. The characteristic rosette was often represented by a large central mass of neutral red granules. The clasmatoocytes resembled the moderately stimulated clasmatoocytes of the connective tissues. The stimulated macrophages which were not typical of either monocytes or clasmatoocytes were classed as indeterminate macrophages. The synovial lining cells did not stain with neutral red.

After death, cells (especially leucocytes) from the subsynovial tissues wandered into the joint and the fluid contained more cells than normal and the differential count was altered.

25. *Further studies on the growth of the skeleton of the white Leghorn chicken.*

HOMER B. LATIMER, University of Nebraska.

The variability in the weight of the long bones was studied by reducing the weight of each bone to a percentage of the entire skeletal weight, and these percentages were studied statistically. The coefficients of variability are as follows: humerus, 13.8; radius, 13.2; ulna, 16.1; femur, 7.9; tibia, 8.4, and the tarsometatarsus, 12.0.

The weight per millimeter of length, supposing that the weight were uniformly distributed throughout the length, was determined for these same six bones. These weights when plotted against body weight form a curve which rises from hatching to maturity, with a flattening of the curve between 1200 and 1600 grams. The humerus and the tarsometatarsus show sex differences, the male bones being heavier.

The ratios of the sum of the lengths of the humerus plus the radius divided by the sum of the lengths of the femur plus the tibia equals 55 per cent at hatching. This rises rapidly to 75 per cent at 200 grams of gross body weight, and then slowly decreases to a little less than 70 per cent. The ratios of the humerus length to the femur length and the similar ratios of the radius and tibia form curves similar to the above. The ratios of the lengths of the bones of the same extremity remain more nearly constant.

26. *Atresia of graafian follicles and the interstitial tissue in the opossum ovary.*

BESSIE LEAGUE (introduced by Carl Hartman), University of Texas.

Atresia of ovarian follicles is a constant phenomenon in *Didelphis*, in anoestrus, as well as in all phases of the oestrous cycle and during pregnancy and lactation; no stage has the advantage as to intensity of the process. Lipolytic precedes chromatolytic degeneration, and hyalin degeneration and the 'Glas-membran' (compare human) are absent. Ripe follicles which fail to ovulate undergo intense lipolysis (compare human), but their incretion is able to stimulate mammary glands and genitalia to exhibit considerable pseudopregnant growth.

Contrary to previous findings, interstitial tissue occurs, although cells fail to attain the size of those in the rabbit (that aberrant form that has set false standard for ovarian interstitial tissue). Large and many small follicles are usually resorbed without leaving a trace. In follicles with beginnings of antra the granulosa may disappear completely, while the theca interna survives and maintains its vascularization, the cells enlarge slightly, and the entire interstitial structure follows precisely the classical descriptions of Limon and successors. The amount of interstitial tissue increases roughly (exceptions!) with age of animal and advance of sexual season. The amount varies from almost zero to an expansion simulating that of rabbit ovary. Transitional stages and absence of degenerative changes favor theory that the cells revert to ovarian stroma. No correlation between amount of interstitial tissue and sexual activity of animal exists.

27. *Models of plant and animal cells; spherical when isolated, cells are tetrakaidecahedra in aggregates.* FREDERICK T. LEWIS, Harvard Medical School.

The shape of cells in such diverse tissues as elder pith and that of the rush *Juncus*, in human fat and in oral epithelium, is primarily tetrakaidecahedral. Models, by which this has been determined, will be demonstrated. (For description, see *Proc. Amer. Acad.*, vol. 61, no. 1). Measurement of the surface area of the models of fat-cells has afforded new and surprising proof of the rôle of surface tension in determining cell shapes. The tetrakaidecahedron has only 58/100 of 1 per cent less surface than the dodecahedron of the same volume, yet so great is the resistance of cells toward deformation which increases their surface that they invariably, so far as known, substitute the complex tetrakaidecahedral piling for the 'normal' dodecahedral piling. As a corollary of this finding, a new approach is offered to the problem of the production of thin, flat endothelial cells. What force deforms their active protoplasm from soft spheroidal shapes, not adherent to any surface, into thin films? Is not the capillary, through surface tension of its stretched endothelial cells, provided with a tireless contractile force, though devoid of a muscle coat? These questions, which are under investigation, suggest possible applications of the results already obtained.

28. *The malignant cell of the chicken sarcoma.* MARGARET REED LEWIS and HOWARD BANCROFT ANDERVONT, Carnegie Laboratory of Embryology and the Department of Filterable Viruses of the School of Hygiene and Public Health of the Johns Hopkins University.

Studies of Rous' chicken sarcoma and of Carrel's indol sarcoma by means of permanent sections, vitally stained spreads, and tissue cultures of the sarcoma show that the cells which form the hyperplasia, invade the muscle and connective tissue, and multiply by mitotic division are the hypertrophied white blood cells. These cells correspond to the cells formed in the cultures of the buffy coat of tumor chickens and of normal chickens. They form in the hanging-drop culture of the whole blood of either the sarcomatous or normal chicken.

The nucleus of the cell is more hypertrophied and the nuclear material is more largely concentrated into masses than in the white blood cells in tissue cultures. Many of the cells are giant cells, some are mononucleated, others are multinucleated. The cells are often full of ingested material and many macrophages are present. Both the giant cells and the macrophages are like exaggerated forms of those of normal blood cells grown in cultures. Most of the cells which grow in tissue cultures of these sarcomas are undoubtedly hypertrophied white blood cells.

Carrel has shown that the mononuclear blood cells in cultures absorb the infectious agent. We have found that the white blood cells of the sarcomatous chicken itself usually contain the infectious agent and that in a large percentage of chickens a tumor can be produced by inoculation with the washed white blood cells taken from the circulating blood of tumor chickens.

29. *The production of transplantable tumors by the inoculation of the plasma or of the washed white blood cells from the blood of sarcomatous chickens.*

MARGARET REED LEWIS and HOWARD BANCROFT ANDERVONT, Carnegie Laboratory of Embryology and the Department of Filterable Viruses of the School of Hygiene and Public Health of the Johns Hopkins University.

That the blood of chickens having either Rous' sarcoma or Carrel's indol tumor contains the infectious body can readily be demonstrated by inoculating other chickens with the constituents of the blood. The animal is first etherized and the blood drawn from the heart together with a little heparin to prevent coagulation. This is centrifuged and 4 cc. of the plasma is injected into the breast muscle of a chicken together with a trace of kaolin. The buffy coat is then removed into several cubic centimeters of sterile Locke solution where the cells are mixed, after which it is centrifuged. After washing in this manner several times, the cells are injected into the breast muscle of another chicken, together with a little sterile kaolin. The plasma and the white blood cells from the same chicken do not always both result in the production of a tumor in the inoculated animals. Serial transplantations by means of the blood have been continued through as many as three generations of malignant tumors. A transplant from the tumor obtained by means of inoculation of either plasma or washed white blood cells has never failed to produce a tumor, even when from the second generation of tumor produced by inoculating with blood instead of with transplants of the tumor itself.

30. *Further studies on the retinae.* P. LINEBACK, Emory University, Georgia.

Further studies on the two retinae of the same individual show added peculiar differences between the two.

An area was calculated, on the serial slides, approximately 0.2 mm. square, with the fovea as its center, and all the nuclei in this field were counted.

In the right fovea there were 2986 modified cones, 715 bipolar cells, and 94 ganglionic cells. In the left fovea there were 2792 modified cones, 1110 bipolar cells, and 342 ganglionic cells. The modified cones predominated in the right fovea by a margin of 194.

Investigation of the monkey's eyes shows a very similar condition in this animal to those of the human type.

31. *Chemical differences in blood as related to sex.* LOUIS J. NEEDELS (introduced by Edgar Allen), University of Missouri School of Medicine.

That the sex glands play an important rôle in the Manoilov reaction is shown by tests: 1) on females throughout the oestrus and menstrual cycles; 2) on castrated males and spayed females, and, 3) on spayed females in which experimental oestrus or menstruation was produced by injection of ovarian and placental hormones. Experimental animals were rats and monkeys.

Early technic followed Manoilov's third modification, suggested by Satina and Demerec, with later change to Steele's modification. Contrary to the results of Popow and of Jegerow, good results have been obtained, using fresh oxalated blood, 0.2 cc. in 3 cc. distilled water. Results were compared with a graded series of color standards ranging from no decolorization (female) to complete decolorization (male).

Results indicate: 1) the degree of oxidation (decolorization) of the blood varies with sex and with age, being greater in males and in young animals; 2) in females oxidation is greatest during oestrus in rats and the intermenstruum in monkeys; 3) removal of the ovaries decreases oxidation; 4) injection of ovarian and placental hormones into spayed rats and monkeys increased decolorization, the reaction approaching the male type; 5) castrated males tend to give a female reaction, i.e., oxidation is decreased; 6) stunted and diseased animals may give atypical results; 7) when these factors are considered, the test is highly accurate.

32. *Variations of the atlas in whites and negroes.* WILLIAM F. OSSENFORT (introduced by R. J. Terry), Washington University, St. Louis.

The groove for the vertebral artery and first cervical nerve varies from a plain groove to a complete foramen, with over half the specimens exhibiting intermediate conditions. The tendency toward a complete foramen is greater in the American negro than it is in the American white. The transverse process is bifid in about half the cases, and the tendency is equal in both races. The costal element is incomplete in a number of cases. The tendency toward this variation is greater in the white. The posterior arch is incomplete in a few instances. This variation is more frequent in the white. Relative height as determined by dividing height by anteroposterior diameter is found to be the same in both races, but the tendency to vary from this average is greater in the white. The above conditions were found in a study of 191 atlases (81 negro, 110 white; see table and curves).

33. *The angle of gait in women.* MRS. SADIE D. PATEK (introduced by A. W. Meyer), Stanford University.

Measurements, by the imprint method used by Dougan (Am. Jr. Phys. Anth., '24), of the angle of gait in 150 university students, revealed but slight differences between the average angle of gait in women and that found by Dougan in men.

My averages for the right and the left foot and for both feet were 6.5°, 7.0°, and 6.8°. The maximum angles were 19.0° on the right and 21.0° on the left.

No effect of instructions to toe straight could be established, and there was no relation between height or strength of arch as indicated by the total deformation produced when the entire body weight was borne on one foot and toeing out. Unyielding arches were found in five persons only. The total deformation of the foot was least when the average outward angle was between 6° and 8°, and this I regard as the normal angle. There seems to be an increase in the angle with weight and age during these years, and asymmetry was the rule.

Toeing in occurred seven times on the right and twice on the left side. None of my series toed in on both sides.

34. *A contribution to the knowledge of the brain in microcephalic idiocy.* J. PARSONS SCHAEFFER, The Daniel Baugh Institute of Anatomy of the Jefferson Medical College.

No abstract received.

35. *The brain in achondroplasia.* J. PARSONS SCHAEFFER, The Daniel Baugh Institute of Anatomy of the Jefferson Medical College.

No abstract received.

36. *A quantitative study of the fetal growth changes of the parts of the human stomach wall.* GORDON H. SCOTT (introduced by R. E. Scammon), Department of Anatomy, University of Minnesota.

The quantitative changes in the growth of the various laminae and the connective-tissue components of the gastric wall are outlined in this study. The relative proportions of these parts as seen in cross-section area of the stomach wall were determined, by the use of a modification of the paper-weight method, for forty-five specimens from five fetal months to birth in age. The weights of the parts per square centimeter of stomach wall and for the entire stomach have also been calculated.

The surface epithelium does not change materially in relative amount, while its calculated weight increases steadily until the tenth fetal month. The crypt epithelium increases steadily both in relative proportion and calculated weight until the last fetal month. The glands follow in general the same changes as the crypt epithelium. There is a tremendous increase, both in relative value and calculated weight, in the submucosa at birth probably due in part to its hyperemia. The longitudinal and oblique muscle strata show an increase of three-fold in computed weight and relative value at the tenth fetal month followed by a decrease at birth. The stratum circulare decreases relatively throughout fetal life, and the calculated weight is highest in the tenth prenatal month.

37. *The growth changes of the surface area of the human gastric mucosa.* GORDON H. SCOTT (introduced by R. E. Scammon), Department of Anatomy, University of Minnesota.

The surface area of the gastric mucosa in a series of seventy-seven specimens, from five fetal months to forty-four years in age, was determined by the method described by Scott (*Am. J. Dis. Child.*, vol. 30, p. 147, '25). The surface area of the mucosa of the stomachs of this series follows the type of growth curve of other observers, although differing in absolute figures. The average areas in square centimeters are: sixth fetal month, 9.65; seventh fetal month, 18.16; eighth fetal month, 23.75; ninth fetal month, 27.20; tenth fetal month, 36.93; birth, 39.17; birth to three months, 123.54; three to six months, 159.58; six to twelve months, 174.52; one to two years, 208.06; two to four years, 235.4; four to seven years, 263.69; seven to fourteen years, 329.31; fourteen to twenty years, 657.91; twenty to sixty years, 525.58.

Experimental studies on distention of the stomach show that the epithelium is not flattened to any appreciable degree by very high pressures. The stomach of the human infant, albino rat, and dog show extremely slight thinning of the epithelial part of the mucosa at pressures near to that required to rupture the organ. This would seem to indicate that the degree of distention of the stomach is not an important factor in the determination of the surface area of the mucosa.

38. *Preparations and drawings to show the development of the supracondylar (entepicondylar) foramen and bar in the cat.* GEORGE A. SEIB (introduced by R. J. Terry), Washington University, St. Louis.

The bar is developed from two points on the cartilaginous humerus, a) the medial epicondyle, b) the shaft. The former appears first and juts proximad toward the somewhat later appearing hook-shaped process of the lower third of the shaft. A mesenchyma bridge connects the two processes which later becomes cartilaginous and remains so for a considerable period after birth. The original two elements become ossified by extension from the shaft center and the intermediate element follows.

39. *A method for preparing the skeleton of cadavers embalmed by carbolic acid.* HORACE R. SKINNER (introduced by R. J. Terry), Washington University, St. Louis.

The bones, from which the soft parts have been removed, are placed in a 1 per cent solution of commercial NaOH at 72°C. for the purpose of removing the phenol. After thorough washing in tap-water, they are macerated at 37°C. in 0.8 per cent saline solution, which is kept slightly turbid by a small amount of precipitated CaCO₃ added to prevent a tendency to acidity. Compressed air injected into the macerating solution serves to stir and maintain the oxygen tension in the bottom of the tank. At the conclusion of maceration, the putrefactive odors are destroyed and the color restored by repeating the NaOH treatment. Finally, the bones are washed and brushed. After the removal of the phenol, the flora of the tap-water is so active as to completely destroy the remains of ligaments of the inferior extremity in thirteen days.

40. *An experiment to test the influence of the sacrotuberous and sacrospinous ligaments in limiting movements of the sacro-iliac joint.* LEITH H. SLOCUMB (introduced by R. J. Terry), Washington University, St. Louis.

Rotary movement of the hip bones on the sacrum was demonstrated by Klein ('91), who fixed the sacrum in a clamp, elevated and lowered the hip bones, and measured the angle of excursion. In the standing posture the weight of the trunk transmitted to the sacrum causes the latter to rotate, the promontory sinking forward, the lower segments of the sacrum moving backward. It is claimed, but apparently on no experimental evidence, that the sacrotuberous and sacrospinous ligaments restrain this movement of rotation. To test this claim the following experiment was devised. The pelvis and lower lumbar spine were cleared of muscles and fixed firmly in an apparatus by which weight could be applied upon the spine and any resulting movement of the sacrum calculated. Observations were made before and after cutting the sacrotuberous and sacrospinous ligaments. The test (thirty pelves) showed, 1) no movement before cutting the ligaments; 2) an excursion backward averaging 0.5° after cutting. Concluded that rotary movements of the sacrum are restrained by the ligaments in question over a small range; beyond this they are checked by other agencies.

41. *Ovulation in the rabbit.* FRANKLIN F. SNYDER, Department of Anatomy, University of Rochester School of Medicine and Dentistry.

Observations are based upon eighteen rabbits between six and twelve months of age, which were daily fed alfalfa, oats, cabbage or carrots, whole milk and salt. They were kept indoors and followed at all seasons of the year.

Smears from the vagina show striking cellular changes, especially with regard to the proportion of leucocytes present. However, no regular cyclic recurrence of the smear changes is noted. Sections of the vaginal wall do not show structural changes more extensive or more regular than those indicated by the smears.

Mating occurs readily in non-pregnant animals, even when the vaginal smear shows a maximal proportion of leucocytes, as well as when leucocytes are practically absent. Ovulation follows mating in such cases. For instance, in five rabbits which were mated when the vaginal smears showed, 1) no leucocytes, 2) few leucocytes, 3) moderate proportion of leucocytes, 4) maximal leucocytes, 5) maximal leucocytes, ova were recovered, respectively, from the fallopian tube as follows: 1) 12½ hours—two-cell stage; 2) 11 hours—non-segmented; 3) 11½ hours—non-segmented; 4) 28 hours—four-cell stage; 5) 72 hours—morula.

Ovulation without mating has not been seen in this series.

42. *Further experiments on the transplantation of the ophthalmic placode of V upon the head of embryos of Amblystoma punctatum.* L. S. STONE, Yale University School of Medicine.

These operations were done upon embryos around stage 26 (tail bud is distinct) and again support previous reports of the ability of a transplanted ophthalmic placode to form a ganglion in new positions upon the head of the embryo. Specimens preserved from six to twenty-eight days after operation show that the ophthalmic placode, grafted in a region dorsal to the auditory anlagen or in the vicinity of the placodes of X, can still form a ganglionic mass in these positions. The placode may increase considerably in size, but remain completely embedded in the skin as a large thickening. It may form a small or large ganglion which is either partly attached to the skin or entirely separated from it. Mitotic figures seem to be more abundant in the ganglion than in the embedded thickening. The implanted ganglion is often intimately associated with lateral-line nerves of X near which it lies. It never has an opportunity to connect directly with the brain in these specimens, for mesenchyme of and around the first somite very early forms a barrier between it and the brain and other ganglia. There seems to be no definite large ophthalmic profundus V nerve, but small nerves sometimes emerge from the grafted ganglion and pass to the vicinity of skin, blood vessels, and pharynx, where they are lost.

43. *Nerve endings and secretory activity in the submaxillary gland of the rabbit.*

DANIEL LYTLE STORMONT (introduced by H. S. Burr), Departments of Anatomy, Chicago University and Yale University.

1. Problem: To determine the exact point of ending of the sympathetic and parasympathetic in the submaxillary gland and to correlate these results with cytological changes following section or stimulation with either the electrical current or drugs.

2. Technique: Superior cervical ganglion removal or sectional chorda. De-generation 6 to 103 days. Gland utilized for modified Cox-Golgi, formol-Zenker, Orth's, Bensley's alcoholic sublimate, and acetic-osmic-bichromate fixations.

Such stains were used as would allow a comparison of the granule content of the tropochrome and homeochrome cells, staining the ducts differentially.

3. Conclusions: It would appear that the cell bodies of the nerve fibers which end about the tropochrome cells, lie in the superior cervical ganglion, while fibers which innervate the ducts and their immediate derivations, homeochrome cells, receive their impulses over the chroda tympani.

These endings, whether secretory or not, certainly concern themselves with the activity of the elements they innervate, as read by the cytological changes within them.

In such a manner, an equilibrium of glandular activity may be maintained, not dependent upon the double innervation of all its cells, but rather upon the single innervation of its component parts—an arrangement not demonstrated in any other effector. It may or may not be general in its application. To my knowledge, this is the first differentiation of specific ending of the parasympathetic and sympathetic in glandular tissue.

44. *The musculature of the superior extremity of the orang-outan.* W. E. SULLIVAN and C. W. OSGOOD, University of Wisconsin.

In analyzing these muscles it must be kept in mind that they are used for locomotion as well as for seizing, holding, and moving objects. As one observes the method of locomotion of the animal, he appreciates necessity of a well-developed musculature for movements of the shoulder-girdle; for movements of the shoulder-joint, especially extension and rotation; for flexion at the elbow-joint; for pronation and supination, and for flexion of the digits. We find these groups exaggerated, with the exception of the last, where the length of the digits gives great mechanical advantage. In our studies we have had an opportunity to observe two living animals, and with these in mind we have tried to interpret the musculature in terms of the orang-outan.

45. *Invariable production of deciduomata in the virgin rat with anterior hypophyseal fluid.* HAROLD M. TEEL (introduced by H. M. Evans), University of California.

Deciduomata from foreign bodies in the endometrium are difficult or impossible to produce in the virgin rat, though frequently produced in conditions which prolong the life-span of the corpora lutea, especially lactation and pseudopregnancy. They are, however, invariably produced if one will administer anterior hypophyseal fluid at the time silk threads are inserted in the uterus and for three or four days thereafter. The procedures are futile after ovariectomy.

46. *Dissections of a white male: the anatomy of the individual.* R. J. TERRY and MILDRED TROTTER, Washington University, St. Louis.

The present conception of the structure of the human body is drawn from the average status of each of its constituent parts, the average being derived from study of the range of variability of each part. Obviously, this conception is not

true for the individual; it is an ideal. It is unlikely that a picture of the structure of an individual has ever been drawn, certainly never in great detail. When this is done we shall have an exact and scientific representation of human constitution in a concrete case—a trustworthy basis for comparisons. An attempt to carry out this idea is being made. The subject is a man of known race, age, and family. His medical history is filed. Somatological measurements and photographs have been made. Dissection of the two sides has been carried on simultaneously; photographs and descriptions of each dissection follow the work; the skeleton is prepared.

47. *Studies on calcification.* JAMES CRAWFORD WATT, Department of Anatomy, University of Toronto.

To learn the manner of deposition of calcium salts in calcified areas was the object of this study.

All the stages of normal calcification were carefully investigated, which occur preparatory to true bone formation in the development of either intracartilaginous or intramembranous bone. For this purpose use was made of developing bones in the human embryo, human foetus, foetal rat, and young guinea-pig and rabbit. The calcium salts are deposited in such intimate relation to the cells and are associated with such changes in the matrix as to lead to the view that their introduction into the matrix is due to cellular activity. Their final state in solid form may be a precipitation phenomenon outside of the cell, but they are placed here primarily by the cell.

Pathological calcification was studied in calcified arteries, thyroid gland, pineal gland, and chorioid plexuses of the brain. The character of the deposit and the areas in which it occurs lead to the opinion that here the deposition of the calcium salts is entirely by means of precipitation *in situ* from soluble salts impregnating the area.

48. *The prevention and cure of tetany by the oral administration of magnesium lactate.* W. F. WENNER (introduced by W. W. Swingle), Osborn Zoölogical Laboratory, Yale University.

Previous work in this laboratory showed that strontium administered orally to parathyroidectomized dogs may prevent, or even cure, tetany. Recent experiments show that magnesium acts similarly.

The parathyroids of nine dogs were removed and 100 cc. of 5 per cent solution of magnesium lactate given orally three times daily. Five animals were completely cured after fifty days' treatment. All showed violent tetany before the twenty-first day following operation. The sixth dog remained free from tetany for ten days, but escaped before the experiment was complete. The remaining three animals survived parathyroidectomy eight, six, and nine days.

Calcium determinations show that magnesium does not replace calcium, but acts in some unknown manner as a calcium sparer and prevents the serum calcium from falling below the level (7 mg. per 100 cc. of blood) at which tetany becomes manifest in dogs.

Magnesium administered to dogs in tetany fails to raise the serum calcium, and the animals eventually die unless the calcium level is elevated to 7 mg. or above.

This can be done by bleeding and administering magnesium, or by feeding milk along with the magnesium. After a few days the calcium rises to 7 mg. or above and can be maintained at this level by magnesium. Milk is given for only a few days.

It is unknown why parathyroidectomized dogs permanently recover after fifty days' treatment with magnesium.

49. *Unmyelinated nerve fibers in the trigeminal nerve.* WILLIAM F. WINDLE, Department of Anatomy, Northwestern University Medical School.

Difficulties encountered in staining the trigeminal nerve by the pyridine-silver method have led several observers to believe that there are very few unmyelinated nerve fibers present there. A study of the best preparations selected from a large number of series of the roots and branches of the trigeminal nerve from the cat reveals that the unmyelinated fibers are not as numerous as they are in the spinal nerves. A comparison of the nerve cells in the ganglion with the myelinated fibers in the root shows that these fibers must represent nearly 40 per cent of the nerve. Actual counts of the unmyelinated fibers in portions of the branches of the trigeminal nerve reveal about 20 per cent unmyelinated fibers. These counts are certainly low, because the compact grouping of the unmyelinated fibers renders them difficult to separate from each other. The nerves to the muscles of mastication contain very few unmyelinated fibers. Pyridine-silver and osmic-acid preparations were always compared.

Evidence is presented that the unmyelinated fibers and probably some of the small myelinated fibers in the trigeminal nerve mediate painful afferent impulses. It is suggested that the lower proportions of unmyelinated fibers in the trigeminal nerve may be due to a higher development in this region than is made evident in myelination of some of the thin fibers.

50. *An anatomical study of the lymphatics of the gall bladder of the cat.* W. L. WINKENWERDER (introduced by G. B. Wislocki), Department of Anatomy, Johns Hopkins University.

Utilizing ligation of the thoracic duct (Lee, '22), dilatation of the lymphatic vessels with incompetence of the valves resulted, which permitted a retrograde injection. Observations establish the presence of a definite plexus of slender lymphatics, regular in caliber, which ramifies in the tunica propria (subepithelial layer) at varying levels and receives finger-like projections, bearing some resemblance to the lacteals of the small intestine, from the larger folds of the mucosa. These finger-like projections extend to the tips of the mucosal folds. Capillaries draining the plexus of the tunica propria penetrate the fibromuscular layer perpendicularly, receiving in transit infrequent, small tributaries from the intermuscular septa. The penetrating lymphatics join an extensive perimuscular plexus which consists of richly anastomosing, large, irregularly dilated lymph vessels. Valves are found to begin here. Numerous vessels project obliquely to form another network of large channels (subserous plexus) superficial to the perimuscular plexus, present on the peritoneal surface of the organ, but absent in the area attached to the liver. Large collecting ducts, three to five in number, drain the subserous plexus and run toward and continue along the left aspect

of the cystic duct, to end in the lymph nodes at the head of the pancreas. Lymph channels from the liver empty into these draining ducts at the cystic duct, but contrary to prevailing opinion, no direct connections between lymphatics of the liver and the plexuses of the gall bladder were obtained.

DEMONSTRATIONS

1. *Tracings, graphs, and tables illustrating the form, position, and involution of the median fontanelles in the living human infant.* F. L. ADAIR and R. E. SCAMMON, Departments of Anatomy and Obstetrics and Gynecology and Institute of Child Welfare, University of Minnesota.
2. *Microscopic sections showing taste buds in the stratified squamous epithelium lining the anterior palatine canals of albino rats.* WILLIAM H. F. ADDISON, University of Pennsylvania.
3. *Certain histological changes which occur in the guinea-pig testis as a result of experimental tuberculosis.* (Work done under grant from the National Tuberculosis Association.) GEORGE A. BAITSELL, KARL E. MASON, and MARION B. SHERWOOD, Osborn Zoological Laboratory, Yale University.
4. *A maquette demonstrating the evolution of the human limb.* O. V. BATSON, Department of Anatomy, University of Cincinnati.
5. *Charts of growth and measurable differences between the mongoloid dwarf and types of the yellow-brown and white races.* R. BENNETT BEAN, School of Anatomy, University of Virginia.
6. *Record forms, graphs, and apparatus for the quantitative study of the physical development of children.* E. BOYD, L. F. RICHDORF, and R. E. SCAMMON, Institute of Child Welfare, University of Minnesota.
7. *X-ray pictures of supracondyloid process; graphs showing incidence in normal whites, negroes, feeble-minded, and inmates of prisons.* L. D. CADY and B. F. FRANCIS (introduced by R. J. Terry), Washington University, St. Louis.
8. *Record of the motile characteristics of cells by the cinemicrograph.* (Filmed by Heinz Rosenberger.) ALEXIS CARREL and ALBERT H. EBELING (introduced by E. V. Cowdry), Rockefeller Institute for Medical Research.
9. *Charts illustrating the early development of the pattern of the motor and sensory centers in the rhombencephalon and spinal cord of Amblystoma.* G. E. COGHILL, The Wistar Institute of Anatomy and Biology.
10. *Charts and graphs illustrating the changes in growth of the human hypophysis during prenatal life.* WALTER P. COVELL (introduced by A. T. Rasmussen), Department of Anatomy, University of Minnesota.
11. a) *Giant-cell formation in the intestinal epithelium of the dog following irradiation.* b) *Epiphyseal synchondroses in long and short bones of the albino rat.* ALDEN B. DAWSON, Department of Biology, New York University.
12. *The blood supply of the maxilla, with special reference to alveolar process and teeth.* RALPH H. FOUSER (introduced by Thesle T. Job), Chicago College of Dental Surgery, Dental Department, Loyola University.
13. *The uterine glands of the sow.* C. H. HEUSER, Carnegie Laboratory of Embryology, Baltimore.
14. *Demonstration of direct color photomicrography for reproduction of histological preparations.* A. B. HOEN and O. O. HEARD (introduced by George L. Streeter), Carnegie Laboratory of Embryology.

15. *Histological changes in the suprarenal cortex produced by various chemical substances and toxins.* NORMAND HOERR (introduced by B. C. H. Harvey), University of Chicago.
16. *The extent of bodily movement possible in rats with severed spinal cord.* DAVENPORT HOOKER, University of Pittsburgh Medical School.
17. *The anatomy of the duodenal portion of the bile and pancreatic ducts.* THESLE T. JOB, Loyola University Medical School.
18. *Microscopical preparations of lymph node of rabbit, showing a transformation of lymphocytes into erythroblasts.* H. E. JORDAN, Laboratory of Histology and Embryology, Medical School, University of Virginia.
19. *Experiments on the development of the ear of *Amblystoma punctatum*.* HELEN W. KAAH (introduced by R. G. Harrison), Yale University.
20. *Special relations of lymphatics, veins, and lymph hearts of amphibia demonstrated in injections of young larvae, anuran and urodele.* H. MCE. KNOWER, University of Georgia Medical School.
21. *Models of plant and animal cells; spherical when isolated cells are tetra-kaidcahedra in aggregates.* (See abstract no. 27, "To be read by title.") FREDERIC T. LEWIS, Harvard Medical School.
22. *Microscopic preparations showing absorption phenomena in the small intestine of experimental animals.* CHARLES C. MACKLIN and MADGE THURLOW MACKLIN, Medical School, University of Western Ontario.
23. *Skeletal material from a gynandromorph fowl.* MADGE THURLOW MACKLIN (introduced by Charles C. Macklin), Medical School, University of Western Ontario.
24. *Dietary morphologic changes in the guinea-pig.* A. W. MEYER, Stanford University.
25. a) *Graphs and charts to show measurements of diameters of liver cells and of their nuclei from 1200 cells of normal and underfed albino rats.* b) *Changes in the mitochondria of the thyroid gland of albino rats due to the effect of starvation.* SHIRLEY P. MILLER, Department of Anatomy, University of Minnesota.
26. *Atlases of whites and negroes showing types of variation; tables and frequency curves.* WILLIAM F. OSSENFORT (introduced by R. J. TERRY), Washington University, St. Louis.
27. *Microscopic sections showing diverticula of the organs of Jacobson in a 150-day albino rat. One diverticulum simulates a small accessory organ of Jacobson.* LEE RADEMAKER (introduced by William H. F. Addison), University of Pennsylvania.
28. *Tables, curves, field graphs, and records illustrating the growth of the normal infant in the first year. A study of the growth of forty-three external dimensions of the body in infancy as determined from measurements of 350 selected children.* LAWRENCE F. RICHDORF (introduced by R. E. Scammon), Departments of Pediatrics and of Anatomy and Institute of Child Welfare, University of Minnesota.
29. *Tables and graphs illustrating a quantitative analysis of the literature of human developmental anatomy.* RICHARD E. SCAMMON, Department of Anatomy and Institute of Child Welfare, University of Minnesota.

30. *Anomalies of the acromioclavicular joint.* P. G. SCHUBE (introduced by O. V. Batson), Department of Anatomy, University of Cincinnati.
31. a) *A series of histograms which show the quantitative proportions of the parts of the human stomach wall at different times during fetal life and at birth.* b) *A series of drawings, at a standard magnification, illustrating the reaction of the gastric mucosa to experimental hyperdistension of the stomach.* GORDON H. SCOTT (introduced by R. E. Seammon), Department of Anatomy, University of Minnesota.
32. *Preparations and drawings to show the development of the supracondylar (entepicondylar) foramen and bar in the cat.* GEORGE A. SEIB (introduced by R. J. Terry), Washington University, St. Louis.
33. *Parts of human skeletons prepared from cadavers embalmed by carbolic acid.* HORACE R. SKINNER (introduced by R. J. Terry), Washington University, St. Louis.
34. *Photograph of apparatus and table of measurements—an experiment to test the influence of sacrotuberous and sacrospinous ligaments in limiting movements of the sacro-iliac joint.* LEITH H. SLOCUMB (introduced by R. J. Terry), Washington University, St. Louis.
35. *Demonstration of embryonic surgery applied to amphibian embryos.* L. S. STONE, Department of Anatomy, Yale University, School of Medicine.
36. *Wax-plate reconstruction, from adult human brain stem, of left lateral recess and aperture of fourth ventricle, accompanied by selected slides and photographs.* R. M. STRONG, LOIS D. GREEN, and J. V. OLIVERIO, Department of Anatomy, Loyola University School of Medicine.
37. *Wax-plate reconstruction of the nucleus and tract solitarius, from adult human brain stem, accompanied by slides and photographs.* R. M. STRONG and T. H. MADAY, Department of Anatomy, Loyola University School of Medicine.
38. *Tables, curves, field graphs, and records illustrating the growth of the human female pelvis in the living from birth to twenty-one years, inclusive. A study based upon 660 collected cases, including a series of serial test measurements of all external pelvic dimensions at various ages and a comparison with previously published findings.* ROY E. SWANSON (introduced by R. E. Seammon), Department of Obstetrics and Gynecology and Department of Anatomy, University of Minnesota.
39. *Charts illustrating the development of the behavior pattern in the fetal albino rat.* E. A. SWENSON (introduced by G. E. Coghill), The Wistar Institute of Anatomy and Biology.
40. *Photograph of dissection of a white male.* R. J. TERRY and MILDRED TROTTER, Washington University, St. Louis.
41. *The changes in the taste buds of foliate and vallate papillae of the rat after section of the glossopharyngeal nerve.* BEATRICE WHITESIDE, Detroit College of Medicine and Surgery.